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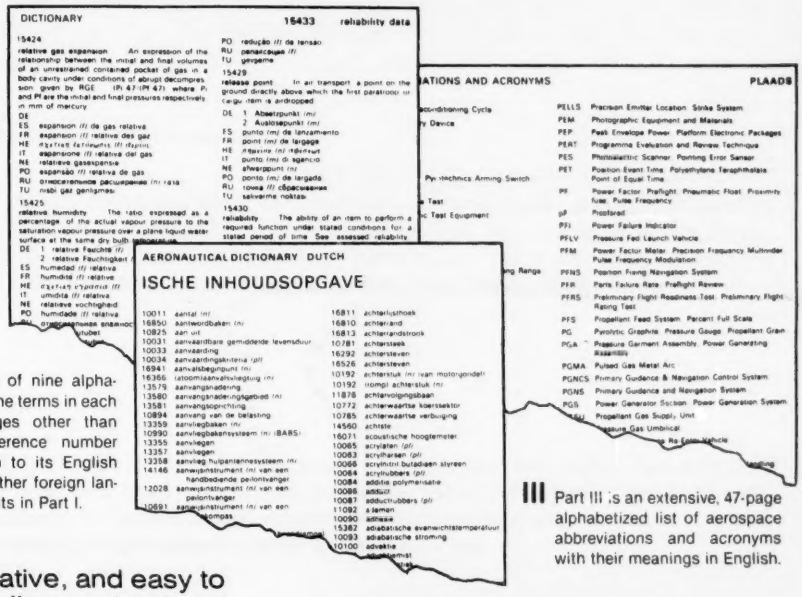
DICTIONARY 15433 reliability data

15424
relative gas expansion An expression of the relationship between the initial and final volumes of an unrestrained contained pocket of gas in a body cavity under conditions of abrupt decompression given by RGE (Pi 47) (Pf 47) where Pi and Pf are the initial and final pressures respectively in mm of mercury.
DE
ES expansion (f) de gas relative
FR expansion (f) relative des gaz
HE
IT espansione (f) relativa del gas
NE relatieve gasexpansie
PO expansão (f) relativa de gás
RU
TU nisbi gaz genişlemesi

15425
relative humidity The ratio expressed as a percentage of the actual vapour pressure to the saturation vapour pressure over a plane liquid water surface at the same dry bulb
DE 1 relative Feuchte (f)
2 relative Feuchtigkeit
ES humedad (f) relativa
FR humidité (f) relative
HE
IT umidità (f) relativa
NE relatieve vochtigheid
PO humidade (f) relativa
RU

PO redução (f) de tensão
RU
TU gerilgeme

15429
release point In air transport a point on the ground directly above which the first parachutist or cargo item is airdropped.
DE 1 Absetzpunkt (m)
2 Auslösepunkt (m)
ES punto (m) de lanzamiento
FR point (m) de largage
HE
IT punto (m) di sganciò
NE afwerppunt (n)
PO ponto (m) de largada
RU точка (f) сбрасывания
TU salıverme noktası

15430
reliability The ability of an item to perform a required function under stated conditions for a stated period of time See assessed reliability

ATIONS AND ACRONYMS PLAADS

coundbraning Cycle
y Device
Pyr rtechnics Arming Switch
e Test
c Test Equipment

PELLS Precision Emitter Location Strike System
PEM Photographic Equipment and Materials
PEP Peak Envelope Power Platform Electronic Packages
PERT Programme Evaluation and Review Technique
PES Photoelectric Scanner Pointing Error Sensor
PET Position Event Time Polyethylene Terephthalate Point of Equal Time
PF Power Factor Preflight Pneumatic Float Proximity fuse Pulse Frequency
pF Prooforad
PFI Power Failure Indicator
PFLV Pressure Fed Launch Vehicle
PFM Power Factor Meter Precision Frequency Multimeter Pulse Frequency Modulation
PFNS Position Fixing Navigation System
PFR Parts Failure Rate Preflight Review
PFRS Preliminary Flight Readiness Test Preliminary Flight Rating Test
PFS Propellant Feed System Percent Full Scale
PG Pyrolytic Graphite Pressure Gauge Propellant Grain
PGA Pressure Garment Assembly Power Generating Assembly
PGMA Pulsed Gas Metal Arc
PGNCS Primary Guidance & Navigation Control System
PGNS Primary Guidance and Navigation System
PGS Power Generator Section Power Generation System
Propellant Gas Supply Unit
ressure Gas Umbilical
Re Entry Vehicle

AERONAUTICAL DICTIONARY DUTCH

ISCHE INHOUDSOPGAVE

10011 aantal (n)
16850 aantwoordbaken (n)
10825 aan uit
10031 aanvaardbare gemiddelde levensduur
10033 aanvaarding
10034 aanvaardingscriteria (pl)
16941 aanvalsbegrippunt (n)
16366 aanvalsmaanvalsvliegtuig (n)
13579 aanvangsnadering
13580 aanvangsnaderingsgebied (n)
13581 aanvangsoprichting
10894 aanvang van de belasting
13359 aanvliegbaken (n)
10990 aanvliegbakensysteem (n) (BABS)
13355 aanvliegen
13357 aanvliegen
13358 aanvlieg hulpantennesysteem (n)
14146 aanwijsinstrument (n) van een handbediende peilantenne
12028 aanwijsinstrument (n) van een peilantenne
10691 aanwijsinstrument (n) van een kompas

16811 achterlijsthoek
16810 achterrand
16813 achterrandstrook
10781 achtersteek
16292 achtersteven
16526 achterstevon
10192 achterstuk (n) van motorgondel
10192 (romp) achterstuk (n)
11878 achtervolgingsbaan
10772 achterwaartse koerssektor
10785 achterwaartse verbuging
14560 achtste
16071 akoestische hoogtemeter
10065 acrylaten (pl)
10083 acrylharsen (pl)
10066 acrylnitril butadiëen styreen
10084 acrylrubbers (pl)
10084 additie polymerisatie
10086 adduct
10087 adductrubbers (pl)
11092 a-lamen
10090 adhesie
15362 adiabatische evenwichtstemperatuur
10093 adiabatische stroming
10100 advektie
[illegible]mist

II Part II consists of nine alphabetized lists of the terms in each of the languages other than English. A reference number keys each term to its English definition and other foreign language equivalents in Part I.

III Part III is an extensive, 47-page alphabetized list of aerospace abbreviations and acronyms with their meanings in English.

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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*

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Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION **794**

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

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05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE **794**

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For related information see also *Aeronautics*

12 ASTRONAUTICS (GENERAL) **801**

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

13 ASTRODYNAMICS **N.A.**

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Includes telemetry; space communications networks; astronavigation; and radio blackout.

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18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE **805**

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Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 825
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics.*

31 ENGINEERING (GENERAL) 828
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 834
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

33 ELECTRONICS AND ELECTRICAL ENGINEERING 839
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuity.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

34 FLUID MECHANICS AND HEAT TRANSFER 841
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

35 INSTRUMENTATION AND PHOTOGRAPHY 844
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation.*

36 LASERS AND MASERS 846
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 848
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 855
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 856
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences.*

42 GEOSCIENCES (GENERAL) 860

43 EARTH RESOURCES 866
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography.*

44 ENERGY PRODUCTION AND CONVERSION 876
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

45 ENVIRONMENT POLLUTION 898
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 899
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation.*

47 METEOROLOGY AND CLIMATOLOGY 903
Includes weather forecasting and modification.

48 OCEANOGRAPHY 907
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) **907**
Includes genetics.

52 AEROSPACE MEDICINE **908**
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES **910**
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT **910**
Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY **N.A.**
Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) **N.A.**

60 COMPUTER OPERATIONS AND HARDWARE **912**
Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

61 COMPUTER PROGRAMMING AND SOFTWARE **913**
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS **915**
Includes computer networks.

63 CYBERNETICS **915**
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

64 NUMERICAL ANALYSIS **916**
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY **918**
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS **920**
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS **921**
Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering.*

70 PHYSICS (GENERAL) **921**
For geophysics see *46 Geophysics.* For astrophysics see *90 Astrophysics.* For solar physics see *92 Solar Physics.*

71 ACOUSTICS **926**
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution.*

72 ATOMIC AND MOLECULAR PHYSICS **928**
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS **932**
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation.*

74 OPTICS **934**
Includes light phenomena.

75 PLASMA PHYSICS **935**
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS **940**
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS **N.A.**
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) **943**
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT **943**
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE **N.A.**
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS **N.A.**
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE **N.A.**
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION **944**
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) **N.A.**

89 ASTRONOMY **944**
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS **945**
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION **946**
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS **946**
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION **N.A.**
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL **946**

Note: N.A. means that no abstracts were assigned to this category for this issue.

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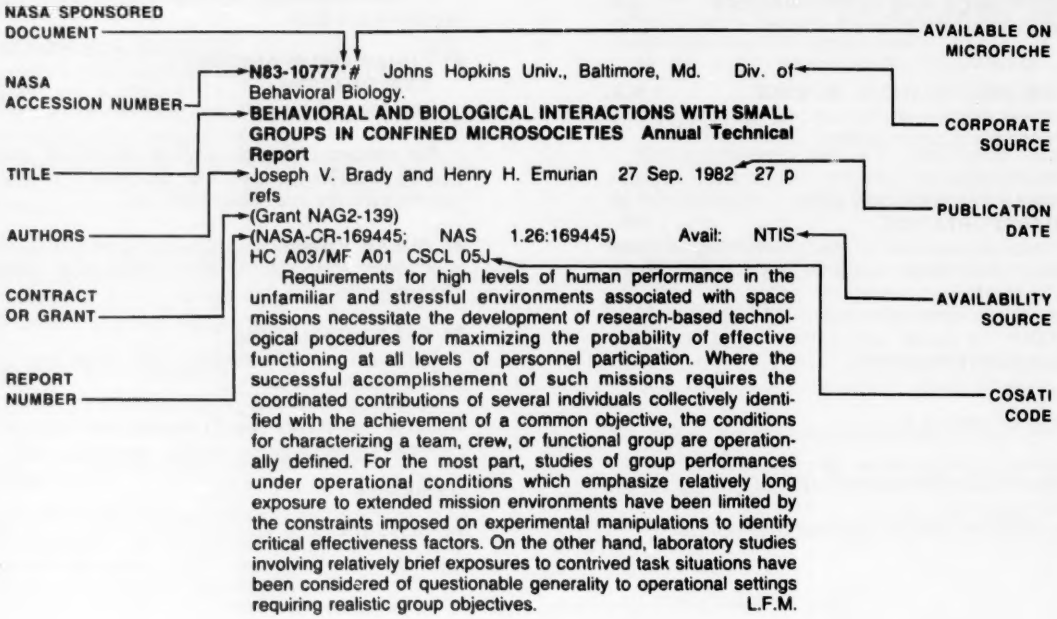
TYPICAL CITATION AND ABSTRACT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N83-10777* # Johns Hopkins Univ., Baltimore, Md. Div. of Behavioral Biology.
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TITLE
BEHAVIORAL AND BIOLOGICAL INTERACTIONS WITH SMALL GROUPS IN CONFINED MICROSOCIETIES Annual Technical Report
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Joseph V. Brady and Henry H. Emurian 27 Sep. 1982 27 p refs
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(NASA-CR-169445; NAS 1.26:169445) Avail: NTIS HC A03/MF A01 CSCL 05J
COSATI CODE
Requirements for high levels of human performance in the unfamiliar and stressful environments associated with space missions necessitate the development of research-based technological procedures for maximizing the probability of effective functioning at all levels of personnel participation. Where the successful accomplishement of such missions requires the coordinated contributions of several individuals collectively identified with the achievement of a common objective, the conditions for characterizing a team, crew, or functional group are operationally defined. For the most part, studies of group performances under operational conditions which emphasize relatively long exposure to extended mission environments have been limited by the constraints imposed on experimental manipulations to identify critical effectiveness factors. On the other hand, laboratory studies involving relatively brief exposures to contrived task situations have been considered of questionable generality to operational settings requiring realistic group objectives. L.F.M.

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N83-15249# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACTA AERONAUTICA ET ASTRONAUTICA SINICA
28 Jul. 1982 217 p refs Transl. into ENGLISH of Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 p 1-103 (AD-A118973; FTD-ID(RS)T-0518-82) Avail: NTIS HC A10/MF A01

Various topics in aeronautical engineering and aerodynamics are discussed. Topics such as supersonic flow, heat transfer, turbine engines, and bearings are discussed. For individual titles, see N83-15250 through N83-15261. R.J.F.

N83-15250# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NUMERICAL SOLUTION FOR THE SUPERSONIC INVISCID FLOW AROUND NON-SYMMETRICAL BODIES **c02**
Guo Zhiquan (Aerodynamic Research and Development Center of China) and Zhang Lumin (Aerodynamic Research and Development Center of China) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 1-24 refs Transl. into ENGLISH from Acta Aeron. et Astron Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

A numerical method for evaluation of the three dimensional inviscid supersonic flow around the reentry vehicles of non-symmetrical bodies is discussed. The method is devoted to determining the initial-boundary value problem for three independent variable first order stationary quasi-linear hyperbolic partial differential equations. MacCormack's explicit finite difference schemes with second order accuracy is adopted. The numerical examples of the bent sphere cones and the reentry vehicles with control flaps were worked out to demonstrate the capability of this computation method. The accuracy of this technique was found to be satisfactory. R.J.F.

N83-15251# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreig.. Technology Div.
EXPERIMENTAL STUDY ON HEAT TRANSFER TO ROUGH WALLS **c34**
Tian Wenbing (Beijing Inst. of Aerodynamics), Li Xue (Beijing Inst. of Aerodynamics), and Mao Mingfang (Beijing Inst. of Aerodynamics) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 25-45 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

Experimental results of heat transfer to rough walls are given for sphere cone models at Mach number 5. The nose radius of the models is 27.4 mm and its base diameter is 60 mm. Five models were tested and the different roughness in its bend diameters are separately 0,0.3,0.5,0.7 and 0.9 mm. The tests were conducted in a conventional hypersonic wind tunnel at total pressures pt of 10-45 kg/cm squared and Reynold's numbers Rep of (0.8-3.6) x one million. The test results indicate that the smooth wall model heating is the laminar flow heating, its heat flux stagnation point is quite close to the laminar flow theoretical data, and the influence of roughness at low total pressure (10kg/cm squared) occurs mainly to promote the transition and development of a boundary layer. R.J.F.

N83-15252# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A GENERALIZED J-INTEGRAL OF 2 DIMENSIONS **c39**
Zhang Xing (Beijing Inst. of Aeronautics and Astronautics) and Wu Guoxun (Beijing Inst. of Aeronautics and Astronautics) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 46-60 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

Beginning from the energy release rate, the generalized J-integral for support of surface forces and body forces of plates with variable thickness in non-uniform temperature fields is derived. The conservation properties of the generalized J-integral are also proved. R.J.F.

N83-15253# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGN CONSIDERATIONS ON GLASS FIBER REINFORCED PLASTIC COMPOSITE STRUCTURES **c27**
Zhu Yiling (Shanghai GRP Research Inst.) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 61-77 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

The use of glass fiber reinforced plastic composite materials for structural design is discussed. The following three points are discussed into account: designability of the material's properties; non-restriction of the structure's configuration; and the linear dispersion strength of the material. R.J.F.

N83-15254# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPUTATION OF STRENGTH AND STABILITY FOR A BUILT STRUCTURE **c39**
Cai Yiping (China Aviation Research Inst.), Song Zenghao (China Aviation Research Inst.), Wang Zhihua (China Aviation Research Inst.), and Zhang Xianwu (China Aviation Research Inst.) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 78-89 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

The solution of strength and stability problems of a built structure by using the finite element method and the increment method for the geometrical nonlinear structural problem is

discussed. Structural elements include bar, plane, beam, space beam, triangular and rectangular plates with membrane stresses and rectangular plate elements with bending deformations. Harmonization between platebar and beam is carried out by using an infinitely stiff component. When the generalized eigenvalue problem is solved with the aid of a simultaneous iteration algorithm, the initial test vector may be automatically generated by means of random numbers. Some techniques in computational procedure are also described, and a few numerical examples are given. A general purpose program in FORTRAN IV language was written. The program possesses the advantages of short computing time, good generality and convenience. R.J.F.

N83-15255# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STUDY ON TIME BETWEEN OVERHAULS (TBO) OF AIRCRAFT TURBOJET AND ITS RELIABILITY **c07**

Zhang Yimin (Shanghai Aviation Industry Corp.) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 90-107 Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)

Avail: NTIS HC A10/MF A01

Statistical methods (frequency histogram, probability paper, linear regression, and chi-square tests) are applied to analyzing time between overhauls (TBO) of aircraft engines. The calculated results of three types of aeroengines showed that the normal distribution is an appropriate model for TBO of aircraft engines. Therefore, along with them given value of TBO, it is reasonable to indicate the probability of the actual operating time of aircraft engines exceeding the given TBO. It is suggested to express the TBO by H(R sub K percent). Thus many unnecessary overhauls can be avoided which is of significant economical importance. R.J.F.

N83-15256# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIMENTAL RESEARCH ON PERFORATED ACOUSTIC LINERS IN TURBOJET ENGINE AFTERBURNERS **c07**

Ou Xuebin (Shenyang Liming Machinery Co.) and Ni Guoxiong *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 108-120 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)

Avail: NTIS HC A10/MF A01

The reasonable choice of construction parameters for perforated acoustic liners in turbojet engine afterburners was investigated from the engineer's point of view. The perforated acoustic liner should have as much as possible high oscillation absorptivity in a quite wide frequency range by increasing the volume of acoustic resonant space and the perforated area ratio of the shield. The smooth geometry of the liner can make the secondary flow uniform around the outer chamber shell and, therefore, avoid high temperature stripes proceeding from the gas separated-flow vortex at the wave valley on the perforated acoustic liner. Consequently, the circular temperature difference and the thermal stresses of the shell can be decreased, and the wall temperature of the afterburner shell can be kept down below the allowable temperature of its material. As a result, the afterburner can operate reliability for a long time. Author

N83-15257# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A TIME INVARIANT STATE ESTIMATOR FOR CONTINUOUS TIME SYSTEMS **c64**

Dai Guanzhong (Northwestern Polytechnical Univ.) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 121-142 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)

Avail: NTIS HC A10/MF A01

The design method of the steady state estimator for linear steady and continuous time systems when the system and measured noise is a smooth white noise process is discussed. To improve the transient performance of the traditional Kalman-Bucy filter definitions two new performance functions are proposed, thus giving two modified Kalman-Bucy filters which can be conveniently applied in engineering. R.J.F.

N83-15258# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SELF-EXCITED RESONANCE OF AEROSTATIC BEARINGS IN A VACUUM ENVIRONMENT **c37**

Fu Xianluo (Academia Sinica) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 143-160 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)

Avail: NTIS HC A10/MF A01

The cause of instabilities in an aerostatic bearing system operated in a vacuum environment is discussed. In order to eliminate this type of self excited resonance, some suitable measures are suggested which can be used to maintain the ambient pressure of the bearing in a range of about + or - 0.2 atm. This will improve the precision of the instruments using aerostatic bearings as well as increase the percentage yield of qualified bearings. R.J.F.

N83-15259# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A NEW COMPLEX ELECTROHYDRAULIC SERVOSYSTEM **c31**

You Jinlu (China Precision Engineering Inst. for Aircraft Industry) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 161-180 Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)

Avail: NTIS HC A10/MF A01

A complex electro-hydraulic system, which increases the ratio of adjustable rates from 180 to about 1800, and improves other technical performances so as to meet the requirements of the servosystem in the flight motion simulator is discussed. Some ratios of adjustable rates of domestic servomotors used in simulators are listed. The reasons for the low ratio of adjustable rates of the piston type motor are analyzed. Some measures to improve it are suggested. The principles of the complex electrohydraulic servosystem are explained. A theoretical analysis is given as well as the block diagrams and transfer functions. Then the dynamic analysis of the complex system is given as well as a comparison with the original one. Finally, the typical data and plots of experiments are given. R.J.F.

N83-15260# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A COMPUTATIONAL GEOMETRY METHOD FOR BLADE SPACE GEOMETRIC DESIGN **c07**

Liu Dingyan (Fundan Univ.), Zhao Yugi (Nanhua Powerplant Research Inst.), Zhang Tingxiong (Nanhua Powerplant Research Inst.), and Xiao Hongen (Nanhua Powerplant Research Inst.) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 181-197 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)

Avail: NTIS HC A10/MF A01

A new method of computer aided blade geometric design is given which combines several typical methods of computational geometry developed recently (including Bezier patches, B-spline patches and Bezier B-spline mixed patches, etc.) with the space shaping for aerojet blades. An integral mathematical model for a blade configuration is obtained and the curved blade is jointed by a set of 3 times 2 order mixed surface patches. Thus, it is advantageous to the computational analysis of the blade's three dimensional flow field performance and limited strength as well as to the combination with numerical control processing. Actual cases show that this method is simple, has a small number of computations and is effective for the design of blades with large curvatures. R.J.F.

N83-15261# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OVERSPEED AND OVERTEMPERATURE TESTS AND DISSECTION EXAMINATION OF THE TURBINE DISCS MADE OF A IRON-NICKEL BASE SUPERALLOY **c07**
Guo Jianting (Academia Sinica) and Zhang Jinan (Academia Sinica) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 198-204 Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

A 35 Ni-15 Cr type iron-nickel base superalloy engine turbine disc material is discussed. It possesses outstanding comprehensive properties and microstructure stability. Therefore, it can meet the requirements of the turbine discs of aeroengines for long time use below 650 to 700 C. For a new type of material to be formally used in an engine it is necessary to go through long time test runs and test flights. However, these types of tests are expensive and long, and so to examine the turbine disc's body and tenon it is reasonable to first conduct overspeed and overtemperature tests on the finished disc. These tests were conducted on Chinese made vertical testers. Six thermoelectric couples are installed on different positions of the turbine disc to measure the temperature field. A photoelectric velocity measurement apparatus and gear velocity measurement apparatus are used simultaneously to measure rotation. R.J.F.

N83-15262# Naval Postgraduate School, Monterey, Calif.
THE AV-8B DECISION M.S. Thesis
Joel L. Goza Jun. 1982 95 p refs
(AD-A119765) Avail: NTIS HC A05/MF A01 CSCL 05/1

This case study of the debate over the decision of the United States Government to procure the McDonnell Douglas AV-8B Advanced Harrier V/STOL jet aircraft for the U.S. Marine Corps includes a history of the development of the AV-8A Harrier, the development of the Marine Corps' concept of employment of V/STOL aircraft, and the development of the AV-8B. The study centers around the actions taken by the Office of the Secretary of Defense, the Department of the Navy, the U.S. Navy, the U.S. Marine Corps, and the Congress of the United States in the controversy over the AV-8B during the period 1977-1980. That controversy was over the decision to equip the Marine light attack force during the 1980's with either the AV-8B Advanced Harrier or the A-18 Hornet to replace worn-out A-4M Skyhawks and AV-8B Harriers. Both sides of the argument over the AV-8B are followed in the context of the PPBS process, the President's budget process, and the Major System Acquisition process. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N83-15263*# California Polytechnic State Univ., San Luis Obispo. Dept. of Aeronautical and Mechanical Engineering.
WIND TUNNEL TESTS OF A FREE-WING/FREE-TRIMMER MODEL Final Report
Doral R. Sandlin NASA Dec. 1982 47 p refs
(Grant NsG-4020)
(NASA-CR-170394; NAS 1.26:170394) Avail: NTIS HC A03/MF A01 CSCL 01A

The riding qualities of an aircraft with low wing loading can be improved by freeing the wing to rotate about its spanwise axis. A trimming surface also free to rotate about its spanwise axis can be added at the wing tips to permit the use of high lift devices. Wind tunnel tests of the free wing/free trimmer model with the trimmer attached to the wing tips aft of the wing chord were conducted to validate a mathematical model developed to predict the dynamic characteristics of a free wing/free trimmer aircraft. A model consisting of a semispan wing with the trimmer mounted on with the wing on an air bearing and the trimmer on a ball bearing was displaced to various angles of attack and released. The damped oscillations of the wing and trimmer were recorded. Real and imaginary parts of the characteristic equations of motion were determined and compared to values predicted using the mathematical model. A.R.H.

N83-15264*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
CRITICAL REVIEW OF THE TRAILING EDGE CONDITION IN STEADY AND UNSTEADY FLOW. BLADE FLUTTER IN COMPRESSORS AND FANS: NUMERICAL SIMULATION OF THE AERODYNAMIC LOADING
Samir F. Radwan, Donald O. Rockwell, and Stanley H. Johnson Dec. 1982 149 p refs
(Grant NsG-3162)
(NASA-CR-169705; NAS 1.26:169705) Avail: NTIS HC A07/MF A01 CSCL 01A

Existing interpretations of the trailing edge condition, addressing both theoretical and experimental works in steady, as well as unsteady flows are critically reviewed. The work of Kutta and Joukowski on the trailing edge condition in steady flow is reviewed. It is shown that for most practical airfoils and blades (as in the case of most turbomachine blades), this condition is violated due to rounded trailing edges and high frequency effects, the flow dynamics in the trailing edge region being dominated by viscous forces; therefore, any meaningful modelling must include viscous effects. The question of to what extent the trailing edge condition affects acoustic radiation from the edge is raised; it is found that violation of the trailing edge condition leads to significant sound diffraction at the tailing edge, which is related to the problem of noise generation. Finally, various trailing edge conditions in unsteady flow are discussed, with emphasis on high reduced frequencies. Author

N83-15265*# Ohio State Univ., Columbus. Dept. of Aeronautical and Astronautical Engineering.
WIND TUNNEL EVALUATION OF AIR-FOIL PERFORMANCE USING SIMULATED ICE SHAPES Final Report
M. B. Bragg, R. J. Zaguli, and G. M. Gregorek Nov. 1982 172 p refs
(Grant NAG3-28)
(NASA-CR-167960; NAS 1.26:167960) Avail: NTIS HC A08/MF A01 CSCL 01A

A two-phase wind tunnel test was conducted in the 6 by 9 foot Icing Research Tunnel (IRT) at NASA Lewis Research Center to evaluate the effect of ice on the performance of a full scale general aviation wing. In the first IRT tests, rime and glaze shapes were carefully documented as functions of angle of attack and free stream conditions. Next, simulated ice shapes were constructed for two rime and two glaze shapes and used in the second IRT tunnel entry. The ice shapes and the clean airfoil were tapped to obtain surface pressures and a probe used to measure the wake characteristics. These data were recorded and processed, on-line, with a minicomputer/digital data acquisition system. The effect of both rime and glaze ice on the pressure distribution, Cl, Cd, and Cm are presented. Author

N83-15266*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND-TUNNEL STUDIES OF THE EFFECTS OF STIMULATED DAMAGE ON THE AERODYNAMIC CHARACTERISTICS OF AIRPLANES AND MISSILES
M. Leroy Spearman Dec. 1982 24 p refs
(NASA-TM-84588; NAS 1.15:84588) Avail: NTIS HC A01/MF A01 CSCL 01A

As an aid in assessing the aerodynamic effects of battle damage that might be sustained by military airplanes or missiles, several wind tunnel investigations were performed at the Langley Research Center in which damage was simulated with models by the removal of all or parts of the wing and tails. Results of the

investigations indicate that the loss of a major part of the vertical tail will probably result in the loss of an airplane in any speed range. The loss of major parts of the horizontal tail generally results in catastrophic instability in the subsonic range but, at low supersonic speeds, and for some planform configurations at subsonic speeds, may allow stable flight to the extent that the airplane might return to friendly territory before the pilot must eject. The results further indicate that major damage to the wing, up to the point of the complete removal of one wing panel, and major damage to the horizontal tail may be sustained without necessarily causing the loss of the airplane or pilot. Author

N83-15267*# California Univ., Los Angeles. Dept. of Mechanics and Structures.
RESPONSE STUDIES OF ROTORS AND ROTOR BLADES WITH APPLICATION TO AEROELASTIC TAILORING Final Report, 1978 - 1982
Peretz P. Friedmann Dec. 1982 17 p refs
(Grant NsG-1578)
(NASA-CR-169740; NAS 1.26:169740) Avail: NTIS HC A02/MF A01 CSCL 10A

Various tools for the aeroelastic stability and response analysis of rotor blades in hover and forward flight were developed and incorporated in a comprehensive package capable of performing aeroelastic tailoring of rotor blades in forward flight. The results indicate that substantial vibration reductions, of order 15-40%, in the vibratory hub shears can be achieved by relatively small modifications of the initial design. Furthermore the optimized blade can be up to 20% lighter than the original design. Accomplishments are reported for the following tasks: (1) finite element modeling of rotary-wing aeroelastic problems in hover and forward flight; (2) development of numerical methods for calculating the aeroelastic response and stability of rotor blades in forward fight; (3) formulation of the helicopter air resonance problem in hover with active controls; and (4) optimum design of rotor blades for vibration reduction in forward flight. A.R.H.

N83-15268*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF SHOCKLESS SUPERCRITICAL AIRFOILS IN CASCADE
D. R. Boldman, A. E. Buggele, and L. M. Shaw 1983 17 p refs Presented at the 21st Aerospace Sci. Conf., Reno, Nevada, 10-13 Jan. 1983; sponsored by the American Inst. of Aeronautics and Astronautics
(NASA-TM-83045; E-1492; NAS 1.15:83045) Avail: NTIS HC A02/MF A01 CSCL 01A

Surface Mach number distributions, total pressure loss coefficients, and schlieren images of the flow are presented over a range of inlet Mach numbers and air angles. Several different trailing edge geometries were tested. At design conditions a leading edge separation bubble was observed resulting in higher losses than anticipated. The minimum losses were obtained at a negative incidence condition in which the flow was accelerating over most of the supercritical region. Relatively minor differences in losses were measured with the different trailing edge geometries studied. Author

N83-15269# Transportation Systems Center, Cambridge, Mass.
CHICAGO MONOSTATIC ACOUSTIC VORTEX SENSING SYSTEM. VOLUME 4: WAKE VORTEX DECAY Final Report, Oct. 1976 - Dec. 1979
D. C. Burnham and J. N. Hallock Jul. 1982 203 p refs 4 Vol.
(AD-A120081; DOT/TSC/FAA-79/18-4;
DOT/FAA/RD-79/103-Vol-4) Avail: NTIS HC A10/MF A01 CSCL 20/4

A monostatic acoustic vortex sensing system (MAVSS) was installed at Chicago's O'Hare International Airport to measure the strength and decay of aircraft wake vortices from landing aircraft. The MAVSS concicts of an array of acoustic antennas which measure the vertical profile up to 60 m altitude of the vertical component of the wind. The decay in wake vortex strength is measured as the vortex passes over successive antennas in the array. Volume 1 (published in October 1979, 32 pages) described the MAVSS principles of operation, the hardware developed, and the data reduction methods employed. Volume 2 (published in September 1981, 162 pages) described the analysis of MAVSS data to exaMINE WHETHER LANDING B-707 and DC-8 aircraft need to remain divided into Heavy and Large categories on the basis of the wake vortex hazard. Volume 3 (published in January 1982, 25 pages) summarized the results of Volume 2 in terms of the safety implications of categorizing all landing B-707s and DC-8s as Large aircraft. In this volume, the statistical methods used to understand wake vortex decay are described and the data on all common jet transport aircraft are presented. GRA

N83-15270# New Technology, Inc., Huntsville, Ala.
AN INVESTIGATION FOR MODELING JET PLUME EFFECTS ON MISSILE AERODYNAMICS
James H. Henderson Jul. 1982 150 p refs
(Contract DAAH01-81-D-A024)
(AD-A120115; AD-E950294; DRSMI/RD-CR-82-25) Avail: NTIS HC A07/MF A01

Results of an investigation of concepts for modeling jet plume effects on missile aerodynamics tend to confirm the concepts proposed by Korst. Comparisons were made of afterbody pressure distributions influenced by plumes of the same shape but with different plume Mach numbers and with a solid plume. These comparisons indicate that increasing effect becoming more pronounced with increasing freestream Mach number. The solid plume has the greatest effect on afterbody pressures with the effect increasing considerably at Mach numbers of 1.25 and higher. GRA

N83-15271# Sandia Labs., Albuquerque, N. Mex. Advanced Energy Projects Div.
DARRIEUS ROTOR AERODYNAMICS
P. C. Klimas 1981 11 p refs Presented at 5th Biennial Wind Energy Conf. and Workshop, Washington, D.C., 5 Oct. 1981 Original language document announced as A82-33708
(Contract DE-AC04-76DP-00789)
(DE82-003495; SAND-81-1701C; CONF-811043-7) Avail: NTIS HC A02/MF A01

Darrieus wind turbines are relatively simple devices. Fixed geometry blades, usually only two or three in number, rotate about a vertical axis providing power to ground mounted power conversion or absorption machinery. No yaw control or power regulation systems are required. This simplicity, however, does not extend to the rotor's aerodynamics. The blade elements travel along circular paths through air whose relative speed and direction are constantly changing. The blade elements operate both unstalled and stalled with aerodynamic stall providing the rotor's inherent power regulation. The blade elements encounter their own wakes and those generated by other elements. These features combine to cause the thorough analysis of Darrieus rotor aerodynamics to be a challenging undertaking. DOE

N83-15250# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NUMERICAL SOLUTION FOR THE SUPERSONIC INVISCID FLOW AROUND NON-SYMMETRICAL BODIES
Guo Zhiquan (Aerodynamic Research and Development Center of China) and Zhang Lumin (Aerodynamic Research and Development Center of China) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 1-24 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N83-15272# Kappa Systems, Inc., Arlington, Va.
SAFETY BENEFITS ANALYSIS OF GENERAL AVIATION COCKPIT STANDARDIZATION Final Report, Jun. 1981 - Sep. 1982
Bruce E. Beddow, Sidney Berger, and Charles E. Roberts, Jr. Atlantic City, N.J. FAA Dec. 1982 115 p refs
(Contract DTFA03-81-C-00058)
(FAA-CT-82-143) Avail: NTIS HC A06/MF A01

Detailed analyses were performed on a sample of 200 accident cases drawn from the National Transportation Safety Board files which contain 2,011 accidents in the period 1975-1979 due to the specified causes. The flight environment, aircraft and pilot characteristics, and their interrelation were fully considered in studies of accident causes. The accident pilot group which contained many high time pilots with advanced certificates was found less qualified with regard to recent night flying and instrument flight time. Fuel systems for all makes and model aircraft of the sample were found to contain great diversity in location of components and operating modes. Powerplant controls are not as diverse in design but still do not conform totally to recommended optimization guidelines. Preventability is determined by identification of standardization guidelines applied to the controls, instruments, and arrangements. Average accident costs are determined by a severity index breakdown and then carefully extrapolated to the full accident data base. Cumulative accident cost reductions are found for a 10 year future period. A proposal for alleviating the pilot nonfamiliarity with specific makes and models is included. In this area, an advisory approach is found preferable to certification and rating structural changes. Author

N83-15273*# Massachusetts Inst. of Tech., Cambridge. Flight Transportation Lab.
THE US AVIATION SYSTEM TO THE YEAR 2000
Raymond A. Austrotas Jul. 1982 123 p refs
(Contract NAS1-15268)
(NASA-CR-166010; NAS 1.26:166010; FTL-R82-6) Avail: NTIS HC A06/MF A01 CSCL 01C

The aviation system of the U.S. is described. Growth of the system over the past twenty years is analyzed. Long term and short term causes of air travel are discussed. The interaction of economic growth, airline yields, and quality of service in producing domestic traffic is shown. Forecasts are made for airline and general aviation growth. Potential airline scenarios are presented. S.L.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N83-15274# Federal Aviation Administration, Atlantic City, N.J. Technical Center.
LORAN-C EN ROUTE ACCURACIES IN THE CENTRAL APPALACHIAN REGION Final Report
Frank Lorge Nov. 1982 30 p refs
(FAA-RD-82-24; FAA-CT-82-32) Avail: NTIS HC A03/MF A01

Flight tests were conducted in the central Appalachian Region of the United States to measure en route Loran-C position accuracies at low altitudes in mountainous terrain. Receivers were configured to use the Northeast and Great Lakes Chains of Loran-C transmitters during the flights while position information and receiver status were recorded. Each of the recorded Loran positions and position information derived from the inertial navigation system were compared. The results were compared against Advisory Circular (AC) 90-45A accuracy criteria for the en route phase of flight. It is concluded that both the Northeast United States Chain and the Great Lakes Chain meet AC 90-45A en route accuracy criteria over the entire flight test area. Author

N83-15275*# Ohio Univ., Athens. Avionics Engineering Center.
ENHANCED CHARACTER SIZES FOR THE VDM-1 VIDEO DISPLAY BOARD
Stanley M. Novacki, III and James D. Nickum Dec. 1982 17 p refs
(Grant NGR-36-009-017)
(NASA-CR-169692; NAS 1.26:169692; TM-83) Avail: NTIS HC A02/MF A01 CSCL 17G

A display enhancement implemented on the new VDM-1 video display board installed in a LORAN-C navigation receiver is addressed. Increased character size for easier viewing of the 3.75 inch diagonal CRT display is provided. Author

N83-15276*# Ohio Univ., Athens. Avionics Engineering Center.
A RF FRONT END INTERFACE AND AGC MODIFICATION
Stephen R. Yost Dec. 1982 16 p refs
(Grant NGR-36-009-017)
(NASA-CR-169691; NAS 1.26:169691; TM-84) Avail: NTIS HC A02/MF A01 CSCL 17G

The latest RF front end built by Burhans (Mini-L-82) was successfully interfaced to the Ohio University LORAN-C receiver. In order for the front end to operate optimally, modifications were made to existing automatic gain control (AGC) circuitry already developed for the Ohio University LORAN-C receiver. The hardware modifications to the AGC and other interface circuitry, as well as some preliminary results are discussed. Author

N83-15277*# Ohio Univ., Athens. Avionics Engineering Center.
A MICROCOMPUTER-BASED POSITION UPDATING SYSTEM FOR GENERAL AVIATION UTILIZING LORAN-C
Joseph P. Fischer May 1982 121 p refs
(Grant NGR-36-009-017)
(NASA-CR-169722; NAS 1.26:169722; TM(NASA)-85) Avail: NTIS HC A06/MF A01 CSCL 17G

Modern digital electronic technology is used to produce a device to convert LORAN C to useful pilot information using a simple software algebra and low cost microprocessor devices. Results indicate that the processor based LORAN C navigator has an accuracy of 1.0 nm or less over an area typically covered by a triad of LORAN C stations and can execute a position update in less than 0.2 seconds. The system was tested in 30 hours of flight and proved that it can give reliable and accurate navigation information. Methods of converting time differences to position, design considerations for the microcomputer system, and the system for coordinate conversion are discussed. Testing with predetermined points and possible fixes for errors are also considered. A.R.H.

N83-15278# Air Force Geophysics Lab., Hanscom AFB, Mass.
AZIMUTH MONITORING EXPERIMENT Final Report
Robert L. Iliff, Roger W. Sands, and Theodore E. Wirtanen 26 Jul. 1982 21 p refs
(AD-A120834; AFGL-TR-82-0200; AFGL-IP-311) Avail: NTIS HC A02/MF A01 CSCL 17/7

With the increase in precision of inertial guidance systems has come a parallel need for techniques to monitor and measure the stability of azimuth references. These azimuth references are used to transfer astronomic direction to inertial system test platforms, for rocket engine test tracks, and for precision test facilities construction, among other requirements. Vibration damping techniques, the peculiarities of differential expansion, refraction, defraction all emphasize that we are building on a living, moving Earth, within the bottom layers of an ocean of air. Thus anything

which can monitor and measure the stability of USAF's carefully surveyed azimuths will help in the progress toward precision. AFGL initiated the concept of monitoring the rotational and translational movements of directional references. GRA

N83-15279# Mitre Corp., McLean, Va.
CONFLICT MONITORING ANALYSIS OF PARALLEL OPPOSITE DIRECTION ROUTES, VOLUME 1
Arthur P. Smith, III Aug. 1982 59 p refs
(Contract DTFA01-82-C-10003)
(AD-A120080; MTR-82W00114-Vol-1; FAA-EM-83-23-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 17/7

A previous report (FAA-EM-80-16) described the estimates of the probability of horizontal overlap and controller intervention rate for same direction adjacent parallel routes. This work extends that methodology to opposite direction adjacent parallel routes. For both the probability of horizontal overlap and the controller intervention rate, trial results based on data are given. GRA

N83-15280# Systems Control Technology, Inc., West Palm Beach, Fla.
THE 3D LORAN-C NAVIGATOR DOCUMENTATION Final Report, May 1981 - Jan. 1982
Eric H. Bolz and Larry D. King Jan. 1982 62 p refs
(Contract DTFA01-80-C-10080)
(AD-A120106; DOT/FAA/RD-82/16) Avail: NTIS HC A04/MF A01 CSCL 17/7

The purpose of this task was to develop a 3D Loran-C Navigator by configuring an interface unit between an airborne Loran-C navigator (Teledyne TDL-711) and an Altitude Alerter/VNAV Guidance system (Intercontinental Dynamics model 541). The digital computer-based interface unit was designed to allow the flight crew to specify the approach slope (3.0 to 9.9 degrees). This report documents the hardware and software in the interface unit, and interconnection with the other involved systems. The availability of accurate, three dimensional approach guidance information at airports where no ILS is available provides significant operational advantages, to helicopter operators in particular. The 3D Loran-C navigator system was bench tested and flight demonstrated. Smooth, accurate (within the limitations of Loran-C) descent guidance information was obtained. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N83-15281# Federal Aviation Administration, Washington, D.C. Program Engineering and Maintenance Service.
USE OF RADAR POSITION REPORTS FOR ESTIMATING AIRCRAFT ACCELERATION Final Report
James A. Shannon Dec. 1982 24 p refs
(FAA-RD-82-81) Avail: NTIS HC A02/MF A01

The possibility of calculating aircraft acceleration from radar position reports using second differences of range bearing data was evaluated. The analysis shows that data provided by the monopulse radar receiver can be sufficiently accurate so that good estimates of acceleration can be calculated. Observations of a B727 aircraft maneuvering at 425 knots and observed by a present generation radar at a distance of 100 to 140 nmi were analyzed. Root mean square heading errors were calculated to be about 5 deg for nonmaneuvering flight. Nine maneuvers, ranging in extent from 9 deg to 174 deg, were observed. Calculation suggests that these can be followed using acceleration calculations with an accuracy of about 10 deg. The peak heading error for one scan is estimated to be 32 deg for a right angle turn. Although impractical for the present generation of ground based computer equipment acceleration estimates will be feasible when the next generation is in place. S.L.

N83-15282*# Kansas Univ. Center for Research, Inc., Lawrence.
ANALYSIS OF NONPLANAR WING-TIP MOUNTED LIFTING SURFACES ON LOW-SPEED AIRPLANES Final Report
C. P. vanDam Dec. 1982 174 p refs
(Grant NsG-1633)
(NASA-CR-169738; NAS 1.26:169738; KU-FRL-427-1) Avail: NTIS HC A08/MF A01 CSCL 01C

The effects of winglets on the lateral directional stability and control of low speed general aviation and agricultural airplanes are researched. Winglet aerodynamic loading is investigated. A lifting surface method is used to conduct a parametric study of the effects of various winglet parameters on lateral directional stability deviative of general aviation type wings. An in flight investigation of winglets mounted on an agricultural airplane was conducted. The consideration involved in the design of winglets for low speed general aviation airplanes are discussed. Author

N83-15283*# Connecticut Univ., Storrs.
IDENTIFICATION AND STOCHASTIC CONTROL OF HELICOPTER DYNAMIC MODES
J. A. Molusis and Y. Bar-Shalom Jan. 1983 73 p refs
(Grant NAG2-72)
(NASA-CR-166425; NAS 1.26:166425) Avail: NTIS HC A04/MF A01 CSCL 01C

A general treatment of parameter identification and stochastic control for use on helicopter dynamic systems is presented. Rotor dynamic models, including specific applications to rotor blade flapping and the helicopter ground resonance problem are emphasized. Dynamic systems which are governed by periodic coefficients as well as constant coefficient models are addressed. The dynamic systems are modeled by linear state variable equations which are used in the identification and stochastic control formulation. The pure identification problem as well as the stochastic control problem which includes combined identification and control for dynamic systems is addressed. The stochastic control problem includes the effect of parameter uncertainty on the solution and the concept of learning and how this is affected by the control's duel effect. The identification formulation requires algorithms suitable for on line use and thus recursive identification algorithms are considered. The applications presented use the recursive extended kalman filter for parameter identification which has excellent convergence for systems without process noise. S.L.

N83-15284# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AIRCRAFT DYNAMIC RESPONSE TO DAMAGED AND REPAIRED RUNWAYS
London Aug. 1982 224 p refs In ENGLISH and FRENCH Meeting held in Cesme, Turkey, 5-10 Apr. 1981 and in Brussels, 4-9 Apr. 1982
(AGARD-CP-326; ISBN-92-835-0316-2) Avail: NTIS HC A10/MF A01

The two purposes of the AGARD conference on aircraft dynamic response to damaged and repaired runways were to review the programs and methods for dynamic analysis and testing of taxiing aircrafts, and to encourage exchange of information on aircraft dynamic response to improve the interoperability of NATO military aircraft. Topics discussed are: (1) advanced rapid runway repair, application of semigrid pavements in rapid runway repair, repaired runway clearance environment, the have bounce program; (2) mathematical modelling of aircraft dynamic response; (3) test methods and correlation with analyses; and (4) designs and clearance. For individual titles, see N83-15285 through N83-15301.

N83-15285# Air Force Engineering and Services Center, Tyndall AFB, Fla.
MINIMUM OPERATING STRIP SELECTION PROCEDURE c09
William S. Strickland and Lapsley R. Caldwell *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 23 p (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

Minimum operating strip (MOS) selection procedures for use in postattack launch and recovery operations are reported. The procedures are based on interim surface roughness guidance and are provided pending development of finalized procedures under the rapid runway repair (RRR) program. The general procedures can be applied to MOS selection for any aircraft at any particular airfield. The MOS selection criteria are to minimize the time required to repair a MOS, prevent damage to the aircraft, and optimize the flexibility in selection of a MOS. Five levels of repair quality, for AM-2 mat and crushed stone repairs, together with a repair spacing criteria for the F-4 aircraft. E.A.K.

N83-15286# Air Force Engineering and Services Center, Tyndall AFB, Fla.

PROPOSED SPECIFICATIONS FOR INTERNATIONAL INTEROPERABILITY ON REPAIRED BOMB DAMAGED RUNWAYS c09

Lapsley R. Caldwell and Anthony G. Gerardi *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 20 p refs Original document was announced as N79-19325 (For primary document see N83-15284 06-05)

Avail: NTIS HC A10/MF A01

Definitions for data, data formats, and National responsibilities for development of war emergency airfield pavement repair specifications was suggested. The specifications are used to make repairs after an enemy attack. Minimum Operating Strip size, repair quality, repair spacing, and other parameters are specified. Exchange of the specifications between the nation operating an aircraft and the nation managing an airfield could enhance NATO interoperability. E.A.K.

N83-15287# United States Air Forces in Europe, APO New York 09012. Force Development Div.

ADVANCED RAPID RUNWAY REPAIR. A STABLE AND FLUSH REPAIRED RUNWAY SURFACE c09

Richard J. Bergholz *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 8 p (For primary document see N83-15284 06-05)

Avail: NTIS HC A10/MF A01

The nature of damage to aircraft launch surfaces that may reasonably be expected to occur during a conflict was examined. The need to develop rapid large area and deep trenched runway repair is suggested, new civil engineering methods to deal with rapid repair of that damage are proposed and effects on aircraft landing gear shock absorbers are postulated. Currently ongoing field investigative efforts to adapt commercially available materials and equipment to provide flush repaired runway surfaces for this expected damage, lessening vertical and horizontal shock forces on aircraft landing gear systems are described. E.A.K.

N83-15288# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

EVALUATION OF THE PILOT PAPERS FROM THE SPRING 1981 SMP MEETING c09

Arnulf Krauss *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 7 p refs (For primary document see N83-15284 06-05)

Avail: NTIS HC A10/MF A01

Two different types of runway damage, regular craters and scabs and penetrated craters are outlined. Minimum operating strip (MOS) selection procedures for use in postattack launch and recovery operations are presented. Examples are given for an F-4 aircraft, yet the general procedures can be applied to MOS selection for any aircraft at any particular airfield. The ground roughness data are supplemented and the scope to the problems to be solved in an environment where a nation managing an airfield is to accommodate other nations operating a variety of aircraft types are expanded. Data on manpower and equipment for rapid runway repair and two runway repair procedures developed and tested in Germany are described. E.A.K.

N83-15289# Centro de Mecanica e Engenharia Estruturais, Lisbon (Portugal). Thermomechanics Section.

APPLICATION OF SEMI-RIGID PAVEMENTS IN RAPID RUNWAY REPAIR c09

A. F. Tovar deLemos *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 4 p ref (For primary document see N83-15284 06-05)

Avail: NTIS HC A10/MF A01

The semirigid pavements are described and compared with the traditional types: the rigid pavements made of cement concrete and flexible pavements made of bituminous concrete. The design and process of application for aeronautic pavements are presented. Experience on the application of semirigid pavements in Europe and in Africa is described. It is emphasized that normally in Portugal this type of pavement is used in new runways, chiefly thresholds, but it is also used for pavement repairs, which are not due to bombs. The merits and disadvantages of the semirigid type pavements as opposed to traditional ones are discussed. E.A.K.

N83-15290# Aeroplane and Armament Experimental Establishment, Boscombe Down (England).

THE REPAIRED RUNWAY CLEARANCE ENVIRONMENT c09

Colin Brain *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 10 p (For primary document see N83-15284 06-05)

Avail: NTIS HC A10/MF A01

Aspects of the repaired runway operational environment which influence considerations of aircraft dynamic response are examined. These aspects include: the roughness of repaired and unrepaired operating surfaces and operational factors which cause variability of aircraft response and pilot techniques which influence the loads on undercarriages. How aircrafts are cleared to operate from repaired runways; the safety margins required for this type of operation and the need to transfer data between NATO nations on the roughness tolerance of individual aircraft types if there is to be genuine interoperability are investigated. E.A.K.

N83-15291# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

THE HAVE BOUNCE PROGRAM

James E. Holpp *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 7 p (For primary document see N83-15284 06-05)

Avail: NTIS HC A10/MF A01

The purpose of the HAVE BOUNCE program which is to define aircraft response to runway repair in a military conflict environment is discussed. Computer programs that model the dynamic and structural response of aircraft are developed and aircraft are tested over simulated repaired runways to gather data for use in validating these computer programs. The HAVE BOUNCE has two objectives: (1) a computer program which models the dynamic response of an aircraft operating over repaired bomb damaged runways; and (2) aircraft operating limitations and guidelines for operation over these repair surfaces. E.A.K.

N83-15292# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

INFLUENCE OF MATHEMATIC MODELLING OF UNDERCARRIAGES ON THE PREDICTION OF AIRCRAFT LOADS DUE TO DAMAGED AND REPAIRED RUNWAYS

Arnulf Krauss, Otto Bartsch, and Gunther Kempf *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 20 p refs (For primary document see N83-15284 06-05)

Avail: NTIS HC A10/MF A01

The peculiarities of the response on damaged runway simulation are described and their influence on the loads assessed. The requirements of digital simulation are referred to. It is shown that simulating an oleopneumatic shock strut as a parallel combination of gas spring and hydraulic damper by far overestimates undercarriage load and hence structural response on shortwave obstacles. It is found that physically existing additional flexibility of the undercarriage in series to the oleo strut must be included in the model. E.A.K.

N83-15293# British Aerospace Aircraft Group, Weybridge (England).
DEVELOPMENT OF A COST EFFECTIVE APPROACH TO MODELLING AIRCRAFT RESPONSE TO REPAIRED RUNWAYS
B. W. Payne, A. E. Dudman, B. R. Morris, and M. Hockenhull *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 12 p (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

The capability of an aircraft to operate from repaired runways which concerns aircraft dynamic response, which causes critical conditions involving aircraft loads and aircraft control is examined. Procedures involve mathematically modelling of the aircraft, which predict response and validate the theory with the test results. A cost effective approach to this problem, which gives results to the fully validated model for the important set of critical loads or accelerations is described. The simplified model may be used to carry out the operational analyses with the full matrix of variables at minimum cost and time, and use of the more accurate model restricted to the minimum necessary to confirm results. E.A.K.

N83-15294# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
STATUS OF COMPUTER SIMULATIONS OF USAF AIRCRAFT AND AN ALTERNATIVE SIMULATION TECHNIQUE c61
Anthony G. Gerardi and Levon Minnetyan (Clarkson Coll.) *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 10 p (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

The formulation of preliminary guidance and evacuation techniques for operating off of damaged runways using existing simulation methods and the status of final surface roughness criteria using the results of the USAF HAVE BOUNCE program is reported. An alternate approach in simulating aircraft response to surface roughness is discussed. The technique is to combine a conventional time history analysis using numerical methods to solve the coupled nonlinear differential equations with a frequency domain analysis to solve the linear substructure equations of motion. The nonlinear landing gear struts and linear structure are solved separately by different techniques and the solution combined to get the total aircraft response. E.A.K.

N83-15295# Avions Marcel Dassault, Saint-Cloud (France).
A METHOD FOR THE NUMERICAL SIMULATION OF AN AIRCRAFT UNDERCARRIAGE SYSTEM [METHODE DE SIMULATION NUMERIQUE DU SYSTEME AVION ATTERRISSEUR] c09
C. Pettau and A. Celier *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 18 p In FRENCH; ENGLISH summary (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

A simulation method, being developed for the dynamic calculation of landing, roll-off, taxiing, takeoff and catapulting impacts, provides the landing-gear loads and the overall structural stresses as functions of time. The calculation takes account of the dynamic response of the structure and the non-linearities of the problem: large rotations, non-linear elasticity of tyres and shock absorbers, oil shearing, dry friction, etc. The implicit integration algorithm proceeds by elimination at different levels, of the freedom degrees of both the linear and linearized parts, leading, at each time step, to the solution of a non-linear equation system relative to the degrees of freedom associated with oil film shearing and dry friction. Shock absorber sticking due to friction can be considered. As the simulation cost is very low, statistical studies can be carried out, especially as regards the simulation of taxiing and takeoff. Author

N83-15296# National Aerospace Lab., Amsterdam (Netherlands).
PREDICTED AND MEASURED LANDING GEAR LOADS FOR THE NF-5 AIRCRAFT TAXIING OVER A BUMPY RUNWAY
H. H. Ottens *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 14 p refs (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

A mathematical model of the NF-5A aircraft was developed. The model is validated using measured results. Landing gear loads are calculated for the aircraft taxiing across a repaired runway using an AM-2 mat. The results depend strongly on the heaving and pitching motion of the aircraft when it meets the repair. E.A.K.

N83-15297# MTS Systems Corp., Minneapolis, Minn.
LABORATORY TESTING SYSTEMS FOR STRUCTURAL DYNAMIC RESPONSE TO LARGE-SCALE DISTURBANCES c39
John W. Piraino *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 8 p refs (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

The application of servohydraulic testing systems which were employed to simulate the environment of heavy duty land vehicles, to investigate the dynamic structural response of aircraft operating in the damaged runway environment is discussed. The control technique known as RPC is described. The test method and its relationship to the computer modeling and field testing approach to the solution of the acceptable runway surface roughness definition is shown. E.A.K.

N83-15298# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
THE PROBLEM OF DESIGN CRITERIA FOR AIRCRAFT LOADS DUE TO ROUGH RUNWAY OPERATION
Max Hacklinger (BWB-ML, Munich) *In its* Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 13 p refs (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

Aircraft design criteria for the rough runway case with emphasis on the initial design were reviewed. The criteria are so divergent in the NATO countries that further design guidance is required to avoid excessively heavy undercarriages of new aircraft projects or shortfalls in interoperability. Nonlinearity and dynamic load cases from multiple obstacle encounter with sometimes adverse operational procedures are the two main problem areas. Groundworthiness criteria for the repaired runway which can provide a reasonable balance of normal operating and rough runway capability are proposed. E.A.K.

N83-15299# Dowty Rotol Ltd., Gloucester (England).
LANDING GEAR SHOCK ABSORBER DEVELOPMENT TO IMPROVE AIRCRAFT OPERATING PERFORMANCE ON ROUGH AND DAMAGED RUNWAYS
G. H. Haines *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 19 p (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

Aircraft landing gear shock absorber characteristics are almost entirely dictated by landing impact energy absorption and suitability to support ground maneuvering loads. To improve the performance of such systems when taxiing on rough or damaged surfaces requires further optimization of the damping level and spring stiffness. Higher damping and softer spring rate than generally used reduces aircraft response when taxiing on typically rough ground. Shock absorber hardware which are developed provides characteristics so modified and tests on single landing gears demonstrate significant taxiing improvements without degrading the landing energy absorption capability. E.A.K.

N83-15300# Lockheed-Georgia Co., Marietta.
ROUGHNESS CONSIDERATIONS FOR TRANSPORT AIRCRAFT
B. M. Crenshaw *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 9 p ref (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

The accurate calculations of landing gear and structural loads which could occur from taxi, takeoff, and landing on repaired bomb-damaged airfields are outlined. Collection of applicable test data was accomplished for two transport aircraft. Tests of the

C-141B aircraft were conducted. To date, C-5A roughness testing consists of traversing (1-cosine) shaped bumps at low speeds. Additional C-5A testing is planned for 1982 to obtain structural response near landing and takeoff speeds. Results are used to validate computer simulation predictions of loads and to assist in the development of operating techniques. E.A.K.

N83-15301# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
A FIGHTER LANDING GEAR FOR THE 1980'S
R. F. Buttles and R. D. Renshaw *In its* Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 13 p (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

Design considerations for a landing gear incorporating soft field, damage/repaired runway, and increased sink speed capabilities over that of current USAF design in a present day fighter/attack aircraft are discussed. The establishment of the design criteria and constraints are discussed, and the resulting configuration is defined as applied to the Northrop F/A-18L aircraft. Shock strut weight and stroke comparisons various fighter landing gears illustrate trends and philosophy differences between land based and carrier based aircraft. The effects of oil loads, air loads, and friction are discussed as design parameter considerations. Shock strut internal geometry philosophy is discussed.

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N83-15302*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FIBEROPTICS TECHNOLOGY AND ITS APPLICATION TO PROPULSION CONTROL SYSTEMS
Robert J. Baumbick 1983 12 p refs Presented at the 21st Aerospace Sci. Conf., Reno, Nevada, 10-13 Jan. 1983; sponsored by the American Inst. of Aeronautics and Astronautics
(NASA-TM-83009; E-1444; NAS 1.15:83009) Avail: NTIS HC A02/MF A01 CSCL 01D

Electro-optical systems have many advantages over conventional electrical systems. Among these are optics' insensitivity to electro-magnetic interference, good electrical isolation and the ability to make measurements in highly explosive areas without risk. These advantages promise to help improve the reliability of future aircraft engine control systems which will be entirely electronic digital. To improve the reliability of these systems, especially against lightning strikes, passive, optical, sensors and fiberoptic transmission lines are being considered for use in future engine systems. Also under consideration are actuators which receive their command signals over fiber optic cables. This paper reviews concepts used for optical instrumentation and actuation systems and discusses work being done by NASA Lewis Research Center in this area. Author

N83-15303# RAND Corp., Santa Monica, Calif.
AVIONICS SOFTWARE: WHERE ARE WE?
Willis H. Ware Sep. 1982 17 p Presented at the AGARD AVP Symp. Software for Avionics, The Hague, 6-10 Sep. 1982
(RAND/P-6786) Avail: NTIS HC A02/MF A01

The issues of surrounding the implementation and management of avionics software resources are discussed. Many positive actions under way are discussed. A direction in which the future may well move is proposed. It is concluded that software will continue to be troublesome; progress will come slowly. R.J.F.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N83-15304*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Energy Efficient Engine Component Development and Integration Program.
ENERGY EFFICIENT HIGH-PRESSURE TURBINE LEAKAGE TECHNOLOGY REPORT
W. B. Gardner Dec. 1980 82 p refs
(Contract NAS3-20646)
(NASA-CR-165202; NAS 1.26:165202; PWA-5594-106) Avail: NTIS HC A05/MF A01 CSCL 21E

The leakage test program was one of such supporting technology programs structured to provide guidance to the Energy Efficient Engine High Pressure Turbine Component Design Effort. Leakage reduction techniques were identified and evaluated. Test models were used to simulate component leak paths and to evaluate leakage reduction techniques. These models simulated the blade/disk attachment, the vane inner platform attachment, and the vane outer platform attachment combined with the blade outer airseal. Disk blade attachment testing indicated that leakage in this area could be reduced to very low levels by paying careful attention to the tolerances along the contact surface between the blade vibration damper and the blade platform contact surface. The aim of feather seal testing was to achieve a goal for an effective leakage gap of one mil (.001 inch) per inch of feather seal length. Results indicated that effective gaps even below the goal level were achievable by (1) maintaining close tolerances between feather seals and their slots to minimize end gaps and limit seal rotation, (2) avoiding feather seal overlap, and (3) minimizing feather seal intersections. W seals were shown to be effective leakage control devices. Wire rope, in its present state of development, was shown not to be an effective sealing concept for application to the component design. Author

N83-15305*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Engineering.
JT9D CERAMIC OUTER AIR SEAL SYSTEM REFINEMENT PROGRAM, PHASE 2
L. T. Shiembob Nov. 1982 48 p refs
(Contract NAS3-20630)
(NASA-CR-167962; NAS 1.26:167962; PWA-5515-175) Avail: NTIS HC A03/MF A01 CSCL 21E

The sprayed ceramic gas turbine outer air seal system was tested in two JT9D engines to substantiate the abradability and durability of the seals. Of particular significance was that one of the tests, a 150 hour 1000 cycle endurance program at nominal JT9D operating conditions, was completed with minimal effect on the seals and received Federal Aviation Administration cognizance with respect to potential field service use by the airlines. The other engine test completed 1825 endurance cycles at severe operating conditions and no burn through or other serious defects in the structural integrity of a seal segment was observed. These test results combined with other Pratt and Whitney Aircraft engine tests substantiate the potential of the ceramic outer air seal system to attain the durability goal of 50000 hour engine operating capability. Both engine tests subjected the seals to intentional blade rubs and demonstrated good abradability with volume wear ratios greater than 100, far exceeding the design goal of 10. The improved volume wear ratio will allow the turbine tip clearance to be reduced, thereby resulting in an estimated thrust specific fuel consumption improvement of 0.3 percent. Author

N83-15306*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF STEADY-STATE PRESSURE DISTORTION ON INLET FLOW TO A HIGH-BYPASS-RATIO TURBOFAN ENGINE
Ronald H. Soeder and George A. Bobula Oct. 1982 31 p refs Prepared in cooperation with Army Aviation Research and Development Command, Cleveland
(NASA-TM-82964; E-1383; NAS 1.15:82964; AVRADCOM-TR-81-C-27) Avail: NTIS HC A03/MF A01 CSCL 21E

Static pressure and total pressure distributions were measured in the inlet duct upstream of the engine inlet and within the fan and compressor of a YTF34 turbofan engine. In addition, the free stream flow angle was measured between the distortion generator and the engine inlet. Distortions were generated using three screen configurations with extents of 90 deg or 180 deg. The screens were mounted on a rotatable screen assembly. Reynolds number index upstream of the distortion device was maintained at 0.5 or 0.2, and engine fan speed corrected to station 2 temperature was maintained at 80 or 90 percent of rated condition (7005 rpm). Flow angle was nearly constant near the distortion device and increased as flow approached the engine inlet. The largest flow angle occurred in the hub region of the engine inlet. Static pressure distortion along the inlet duct increased exponentially as the flow approached the engine. Both static pressure and total pressure distortions were attenuated between engine inlet and compressor exit. Author

N83-15307*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FEASIBILITY OF WATER INJECTION INTO THE TURBINE COOLANT TO PERMIT GAS TURBINE CONTINGENCY POWER FOR HELICOPTER APPLICATION
G. James VanFossen 1983 16 p refs Proposed for presentation at the 28th Ann. Intern. Gas Turbine Conf., Phoenix, Ariz., 27-31 Mar. 1983; sponsored by the American Society of Mechanical Engineers
(NASA-TM-83043; E-1490; NAS 1.15:83043) Avail: NTIS HC A02/MF A01 CSCL 21E

A system which would allow a substantially increased output from a turboshaft engine for brief periods in emergency situations with little or no loss of turbine stress rupture life is proposed and studied analytically. The increased engine output is obtained by overtemperaturing the turbine; however, the temperature of the compressor bleed air used for hot section cooling is lowered by injecting and evaporating water. This decrease in cooling air temperature can offset the effect of increased gas temperature and increased shaft speed and thus keep turbine blade stress rupture life constant. The analysis utilized the NASA-Navy-Engine-Program or NNEP computer code to model the turboshaft engine in both design and off-design modes. This report is concerned with the effect of the proposed method of power augmentation on the engine cycle and turbine components. A simple cycle turboshaft engine with a 16:1 pressure ratio and a 1533 K (2760 R) turbine inlet temperature operating at sea level static conditions was studied to determine the possible power increase and the effect on turbine stress rupture life that could be expected using the proposed emergency cooling scheme. The analysis showed a 54 percent increse in output power can be achieved with no loss in gas generator turbine stress rupture life. A 231 K (415 F) rise in turbine inlet temperature is required for this level of augmentation. The required water flow rate was found to be .0109 kg water per kg of engine air flow. B.W.

N83-15308*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
MATERIALS FOR ADVANCED TURBINE ENGINES. VOLUME 1: ADVANCED BLADE TIP SEAL SYSTEM Final Report
J. W. Zelahy and N. P. Fairbanks Jul. 1982 99 p
(Contract NAS3-20074)
(NASA-CR-167851; NAS 1.26:167851; R82AEB403-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 21E

Project 3, the subject of this technical report, was structured toward the successful engine demonstration of an improved-efficiency, long-life, tip-seal system for turbine blades. The advanced tip-seal system was designed to maintain close operating clearances between turbine blade tips and turbine shrouds and, at the same time, be resistant to environmental effects including high-temperature oxidation, hot corrosion, and thermal cycling. The turbine blade tip comprised an environmentally resistant, activated-diffussion-bonded, monocrystal superalloy combined with a thin layer of aluminium oxide abrasive particles entrapped in an electroplated NiCr matrix. The project established the tip design and joint location, characterized the single-crystal tip alloy and abrasive tip treatment, and established the manufacturing and quality-control plans required to fully process the blades. A total of 171 blades were fully manufactured, and 100 were endurance and performance engine-tested. Author

N83-15309*# Michigan Univ., Ann Arbor. Coll. of Engineering.
IGNITION AND COMBUSTION: LOW COMPRESSION RATIO, HIGH OUTPUT DIESEL Final Report, Sep. 1979 - 30 Apr. 1979
Jul. 1981 43 p ref
(Grant NsG-3161)
(NASA-CR-169742; NAS 1.26:169742) Avail: NTIS HC A03/MF A01

The feasibility of converting a spark ignition aircraft engine GTSI0-520 to compression ignition without increasing the peak combustion pressure of 1100 lbs/sq.in. was determined. The final contemplated utilized intake air heating at idle and light load and a compression ratio of about 10:1 with a small amount of fumigation (the addition of about 15% fuel into the combustion air before the cylinder). The engine used was a modification of a Continental-Teledyne gasoline engine cylinder from the GTSI0-520 supercharged aircraft engine. S.L.

N83-15310# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
RESPONSE SENSITIVITY OF TYPICAL AIRCRAFT JET ENGINE FAN BLADE-LIKE STRUCTURES TO BIRD IMPACTS Final Report, 1 Oct. 1977 - 30 Jan. 1979
David P. Bauer and Robert S. Bertke Wright-Patterson AFB, Ohio AFWAL May 1982 49 p refs
(Contract F33615-77-C-5221; AF Proj. 3066)
(AD-A119974; AFWAL-TR-82-2045) Avail: NTIS HC A03/MF A01 CSCL 21/5

The response sensitivity of jet engine fan blade-like structures to the details of impact loading were studied. In particular, impacts of birds and ice on jet engines are difficult to model analytically. This report provides guidance in determining the spacial and temporal loading parameters that must be most accurately modeled in a coupled load-response analysis. A finite element model of a cantilever plate was subjected to various spatial and temporal loading details to determine important parameters. The cantilever plate was 7.62 cm (3 inches) by 24.46 cm (9.63 inches) by 3.81 mm to a 85 g (3 ounce) bird impacting at 244 m/sec (800 ft/sec). The plate response was monitored by observing deflected shapes at several increments of time during and after impact. The results show that the cantilever plate and presumably a jet engine fan blade are very sensitive to the level of momentum transfer. The detailed spatial and temporal loads that most affect momentum transfer were found to be of particular importance to the structure response. GRA

N83-15311# Systems Control Technology, Inc., Palo Alto, Calif.
TURBINE ENGINE FAULT DETECTION AND ISOLATION PROGRAM. VOLUME 1: TURBINE ENGINE PERFORMANCE ESTIMATION METHODS Final Report, 15 Aug. 1979 - 30 Nov. 1981
Carolyn Smith, Mark Broadie, and Ronald DeHoff Wright-Patterson AFB, Ohio AFWAL Aug. 1982 252 p refs 2 Vol.
(Contract F33615-78-C-2062; AF Proj. 3066)
(AD-A119998; AFWAL-TR-82-2058-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 21/5

This report documents work done for the Turbine Engine Fault Detection and Isolation Program. A gas path performance algorithm has been developed which can be used to trend engine module

health. The Maintenance Information Management System was developed for the integration of data into the maintenance framework of the services. These tools have been applied to test data from the F100/EDS, TF34/TEMS and TF41/IECMS data acquisition systems. Author (GRA)

N83-15312# Systems Control Technology, Inc., Palo Alto, Calif.
TURBINE ENGINE FAULT DETECTION AND ISOLATION PROGRAM. VOLUME 2: MAINTENANCE MODEL DEVELOPMENT Final Report, 15 Aug. 1979 - 30 Nov. 1981
Randall Fleming and Ronald DeHoff Wright-Patterson AFB, Ohio AFWAL Aug. 1982 82 p refs 2 Vol.
(Contract F33615-78-C-2062; AF Proj. 3066)
(AD-A119999; AFWAL-TR-82-2058-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 21/5

Maintenance decision analysis models for evaluation of the TF34 maintenance process, both with and without the Turbine Engine Monitoring System (TEMS), are formulated. These models form the foundation for the U.S. Air Force to establish techniques for determining optimal policy for troubleshooting and maintenance on its aircraft engines using decision analysis methods. Technical background is provided and models presented. Model structure and parameters, as well as input and output, are treated. A preliminary plan for model evaluation is given, including methods for data collection, model evaluation criteria, as well as solution techniques and algorithms for the actual model evaluation. Conclusions are drawn and directions for future activity are suggested. GRA

N83-15313# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.
EXPERIMENTAL INVESTIGATION OF THRUST AUGMENTING EJECTORS USING VANE EXCITED PRIMARY JETS M.S. Thesis
Thomas Robert McClellan Mar. 1982 143 p refs
(AD-A120424) Avail: NTIS HC A07/MF A01 CSCL 21/5

An experimental investigation has been conducted to evaluate the entrainment characteristics of a thrust augmenting ejector, with a small, oscillating airfoil inserted in the potential core of the primary jet. Velocity distributions were measured across the width of the jet, at downstream distances of 20 and 40 nozzle widths, with the jet exhausting into still air and with the jet exhausting into an instrumented ejector shroud for the following range of parameters: Pressure ratio 1.137 and 1.268, amplitude of oscillation 2.6 deg and 6.9 deg zero-to-peak frequency of oscillation 0, 20, 40 and 60 Hz. Static pressure distributions were measured within the shroud when the jector was installed. The results amplify previously conducted studies. Jet spreading and entrainment appear to increase with increasing amplitude and frequency of oscillation and to decrease with increasing nozzle pressure ratio. Author (GRA)

N83-15314# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
COMPUTER PROGRAM FOR CALCULATION OF TURBOJET SYSTEM PERFORMANCE Final Report
Joseph J. Franz 15 Jun. 1982 125 p refs
(AD-A120665; NADC-77022-30) Avail: NTIS HC A06/MF A01 CSCL 21/5

A computer program has been written which calculates combined turbojet engine, air induction and exhaust system characteristics to produce integrated propulsion system performance. GRA

N83-15255# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY ON TIME BETWEEN OVERHAULS (TBO) OF AIRCRAFT TURBOJET AND ITS RELIABILITY
Zhang Yimin (Shanghai Aviation Industry Corp.) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 90-107 Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

N83-15256# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL RESEARCH ON PERFORATED ACOUSTIC LINERS IN TURBOJET ENGINE AFTERBURNERS
Ou Xuebin (Shenyang Liming Machinery Co.) and Ni Guoxiong *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 108-120 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

N83-15260# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A COMPUTATIONAL GEOMETRY METHOD FOR BLADE SPACE GEOMETRIC DESIGN
Liu Dingyan (Fundan Univ.), Zhao Yugi (Nanhua Powerplant Research Inst.), Zhang Tingxiong (Nanhua Powerplant Research Inst.), and Xiao Hongen (Nanhua Powerplant Research Inst.) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 181-197 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

N83-15261# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OVERSPEED AND OVERTEMPERATURE TESTS AND DISSECTION EXAMINATION OF THE TURBINE DISCS MADE OF A IRON-NICKEL BASE SUPERALLOY
Guo Jianting (Academia Sinica) and Zhang Jinan (Academia Sinica) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 198-204 Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

N83-15511# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
THE OIL/AIR SYSTEM OF A MODERN FIGHTER AIRCRAFT ENGINE
J. Schmidt, W. K. Hank, A. Klein, and K. Maier *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 19 p ref (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N83-15315*# Lockheed-Georgia Co., Marietta.
DIGITAL FLIGHT CONTROL SYSTEM VALIDATION TECHNOLOGY ASSESSMENT Final Report
D. B. Mulcare, W. G. Ness, and R. M. Davis Moffett Field, Calif. NASA. Ames Research Center Jul. 1982 134 p refs Sponsored in cooperation with FAA
(Contract NAS2-10270)
(NASA-CR-166374; NAS 1.26:166374; FAA-CT-82-140) Avail: NTIS HC A07/MF A01 CSCL 01C

This report presents a description and critique of digital flight control system technology with emphasis on real time simulation. This includes methods to define test cases as well as those to apply them. Particular attention is also directed toward the significance of embedded software, implementation variations, documentation methods, and vital issues in validation technology research. Author

N83-15316*# Bendix Corp., Teterboro, N. J.
ADVANCED FLIGHT CONTROL SYSTEM STUDY Final Contractor Report
John C. McGough, Kurt Moses, and John F. Klafin (Grumman Aerospace Corp., Bethpage, N.Y.) Nov. 1982 374 p refs
(Contract NAS4-2877)
(NASA-CR-163120; NAS 1.26:163120; B-82SRC5) Avail: NTIS HC A16/MF A01 CSCL 01C

The architecture, requirements, and system elements of an ultrareliable, advanced flight control system are described. The basic criteria are functional reliability of 10 to the minus 10 power/hour of flight and only 6 month scheduled maintenance. A distributed system architecture is described, including a multiplexed communication system, reliable bus controller, the use of skewed sensor arrays, and actuator interfaces. Test bed and flight evaluation program are proposed. E.A.K.

N83-15317*# Analytical Mechanics Associates, Inc., Hampton, Va.
ANALYTICAL PROCEDURES FOR FLUTTER MODEL DEVELOPMENT AND CHECKOUT IN PREPARATION FOR WIND TUNNEL TESTING OF THE DAST ARW-1 WING
Samuel Pines Dec. 1982 87 p refs
(Contract NAS1-15593)
(NASA-CR-166023; NAS 1.26:166023; AMA82-35) Avail: NTIS HC A05/MF A01 CSCL 01C

A study to develop analytical procedures to be used in the checkout and calibration of a flutter wind tunnel model of the DAST ARW-1 wing equipped with a flutter suppression device is reported. The methods used to obtain a realistic simulation of the structural inertial and aerodynamic properties of the wing, the hydro-electro-servo actuator used for flutter suppression, a prediction of the open loop flutter speed at a fixed Mach number (.897), a procedure for checkout and calibration using the method frequency response of a wing mounted accelerometer, and an analytical representation of a reduced state approximation of the overall system are described. Author

N83-15318*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
INTEGRATED RESEARCH AIRCRAFT CONTROL TECHNOLOGY WITH FULL AUTHORITY DIGITAL ELECTRONIC CONTROL
Apr. 1980 118 p refs Sponsored in part by the Navy and the Air Force
(Contract NAS4-2556)
(NASA-CR-163100; FR-11792; NAS 1.26:163100) Avail: NTIS HC A06/MF A01 CSCL 01C

Baseline definitions for three major areas of the Integrated Research Aircraft Control Technology (INTERACT) program are provided. Author

N83-15319*# George Washington Univ. Hampton, Va. Joint Inst. for the Advancement of Flight Sciences.
THE USE OF LATERALLY VECTORED THRUST TO COUNTER THRUST ASYMMETRY IN A TACTICAL JET AIRCRAFT Final Report, Oct. 1980 - Oct. 1982
Jan. 1983 95 p refs
(Contract NCC1-29)
(NASA-CR-166047; NAS 1.26:166047) Avail: NTIS HC A05/MF A01 CSCL 01C

A nonlinear, six degree-of-freedom flight simulator for a twin engine tactical jet was built on a hybrid computer to investigate lateral vectoring of the remaining thrust component for the case of a single engine failure at low dynamic pressures. Aircraft control was provided by an automatic controller rather than a pilot, and thrust vector control was provided by an open-loop controller that deflected a vane (located on the periphery of each exhaust jet and normally streamlined for noninterference with the flow). Lateral thrust vectoring decreased peak values of lateral control deflections, eliminated the requirement for steady-state lateral aerodynamic control deflections, and decreased the amount of altitude lost for a single engine failure. Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N83-15320*# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
DEVELOPMENT OF THE DESIGN CONCEPTS FOR A MEDIUM-SCALE WIND TUNNEL MAGNETIC SUSPENSION SYSTEM Final Report, Feb. 1977 - Sep. 1982
R. R. Humphris and R. N. Zapata Dec. 1982 37 p refs
(Grant NsG-1010)
(NASA-CR-166042; NAS 1.26:166042; UVA/643078-MAE82-111) Avail: NTIS HC A03/MF A01 CSCL 14B

The magnitude of AC losses from a superconducting coil strongly indicates that the predicted scaling lawa are valid. The stainless steel bands around the test coil were the source of additional helium boiloff due to a transformer action and, hence, caused erroneously high AC loss measurements in the first run. However, removal of these bands for the second run produced data which are consistent with previous results on small scale multifilamentary superconducting coils. S.L.

N83-15321# Los Alamos Scientific Lab., N. Mex.
DESIGN OF THE CTX DIAGNOSTICS SCREEN ROOM
George I. Chandler, II 1981 5 p refs Presented at the 9th Symp. on Eng. Problems of Fusion Res., Chicago, 26-29 Oct. 1981
(Contract W-7405-eng-36)
(DE82-002320; LA-UR-81-3150; CONF-811040-57) Avail: NTIS HC A02/MF A01

The design of a shielded enclosure (or screen room) to house data acquisition equipment in an area in which substantial, time varying magnetic fields are present and capable of producing significant interference is described. The experiment, including power supplies, energy storage, control and other equipment covers several thousand square feet. The components are arranged electrically along the legs of a star ground system. Diagnostics apparatus located near the plasma vessels are connected to the screen room primarily with RG223 coaxial cables. DOE

N83-15322# Atomic Energy Research Establishment, Harwell (England). Computer Science and Systems Div.
AN EFFICIENT FULLY IMPLICIT SIMULATOR
B. A. Foster, P. F. Naccache, M. O. Nicholas, R. K. Pollard, D. K. Ponting, J. Rae, D. Banks (British National Oil Corp., Glasgow), and S. K. Walsh (AEE Winfrith) May 1982 39 p refs
(CSS-126) Avail: NTIS HC A03/MF A01

An efficient general purpose black oil simulator, PORES, now in production use for modelling North Sea fields is described. The fully implicit finite diifference equations are solved for each time step using a Newton-Raphson procedure. The resulting large sets of linear equations are usually solved simulataneously by a powerful iterative method which uses a preconditioned conjugate gradient algorithm with an enforced column sum condition to accelerate convergence. A sequential solution option is available and direct matrix inversion methods are also provided. Gas condensate problems are handled by a variable switching technique. Four examples are presented to illustrate the power and efficiency of the program. S.L.

N83-15285# Air Force Engineering and Services Center, Tyndall AFB, Fla.
MINIMUM OPERATING STRIP SELECTION PROCEDURE
William S. Strickland and Lapsley R. Caldwell *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 23 p (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

N83-15286# Air Force Engineering and Services Center, Tyndall AFB, Fla.
PROPOSED SPECIFICATIONS FOR INTERNATIONAL INTEROPERABILITY ON REPAIRED BOMB DAMAGED RUNWAYS
Lapsley R. Caldwell and Anthony G. Gerardi *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 20 p refs Original document was announced as N79-19325 (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

N83-15287# United States Air Forces in Europe, APO New York 09012. Force Development Div.
ADVANCED RAPID RUNWAY REPAIR. A STABLE AND FLUSH REPAIRED RUNWAY SURFACE
Richard J. Bergholz *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 8 p (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

N83-15288# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
EVALUATION OF THE PILOT PAPERS FROM THE SPRING 1981 SMP MEETING
Arnulf Krauss *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 7 p refs (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

N83-15289# Centro de Mecanica e Engenharia Estruturais, Lisbon (Portugal). Thermomechanics Section.
APPLICATION OF SEMI-RIGID PAVEMENTS IN RAPID RUNWAY REPAIR
A. F. Tovar deLemos *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 4 p ref (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

N83-15290# Aeroplane and Armament Experimental Establishment, Boscombe Down (England).
THE REPAIRED RUNWAY CLEARANCE ENVIRONMENT
Colin Brain *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 10 p (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

N83-15295# Avions Marcel Dassault, Saint-Cloud (France).
A METHOD FOR THE NUMERICAL SIMULATION OF AN AIRCRAFT UNDERCARRIAGE SYSTEM [METHODE DE SIMULATION NUMERIQUE DU SYSTEME AVION ATTERRISSEUR]
C. Pettau and A. Celier *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 18 p In FRENCH; ENGLISH summary (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N83-15323* National Aeronautics and Space Administration, Washington, D. C.
TECHNOLOGY FOR LARGE SPACE SYSTEMS: A SPECIAL BIBLIOGRAPHY
Jan. 1982 69 p
(NASA-SP-7046(06); NAS 1.21:7046(46)) Avail: NTIS HC $9.00 CSCL 22A

This bibliography lists 220 reports, articles and other documents introduced into the NASA scientific and technical information system between July 1, 1981 and December 31, 1981. Its purpose is to provide helpful information to the researcher, manager, and designer in technology development and mission design in the area of the Large Space Systems Technology (LSST) Program. Subject matter is grouped according to systems, interactive analysis and design, structural concepts, control systems, electronics, advanced materials, assembly concepts, propulsion, solar power satellite systems, and flight experiments. Author

N83-15324*# National Aeronautics and Space Administration, Washington, D. C.
THE US AT UNISPACE '82 SATELLITE COMMUNICATIONS, VIENNA, AUSTRIA
1982 8 p Original contains color illustrations
(NASA-TM-85191; NAS 1.15:85191) Avail: NTIS HC A02/MF A01 CSCL 22A

The demand for satellite communications continues to grow for television, telephony and data. Technical developments are expanding the capacity to meet these demands. Research into higher frequencies, satellite clusters and large platforms is continuing. Narrowband communication to small Earth terminals for the developing nations of the world is being developed. The Space Shuttle will help to make these satellite services economically available. The United States continues to pursue the peaceful uses of space. S.L.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N83-15325# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COURSE IN METEOROLOGICAL SATELLITES. PART C: APPLICATIONS AND PHOTOINTERPRETATION [CURSO DE SATELITES METEOROLOGICOS - APLICAQOES E FOTO INTERPRETACAO - PARTE C]
Nelson deJesus Ferreira, Marlene Elias, Michael Allan Fortune, Marco Antonio Maringolo Leme, and Vernon Edgar Kousky [1982] 63 p refs In PORTUGUESE Original contains color illustrations
(INPE-2235-MD/15-Pt-C) Avail: NTIS HC A04/MF A01

Chapters 15 through 17 of the course are presented. Satellite imagery taken during the severe frost of July 1981 is analyzed; short range synoptic weather forecasting of the freeze using data from the SMS meteorological satellite is described; low temperatures during the frost were mapped using infrared SMS data; and ground truth documentation of the frost is presented. The use of satellite data for numerical weather forecasting is compared to the use of data from a conventional weather station network.

Interpretation of satellite imagery of the processes of cloud formation induced by free and forced convection; the formation of cirrus, altostratus, and cumulonimbus clouds; and the configurations and types of clouds associated with a typical midlatitude low pressure system are discussed. J.D.

N83-15326*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA CATALOG SERIES FOR SPACE SCIENCE AND APPLICATIONS FLIGHT MISSIONS. VOLUME 1A: BRIEF DESCRIPTIONS OF PLANETARY AND HELIOCENTRIC SPACECRAFT AND INVESTIGATIONS
Winifred Sawtell Cameron, ed. and Robert W. Vostreys, ed. Sep. 1982 128 p 2 Vol.
(NASA-TM-84877; NSSDC/WDC-A-R/S-82-21-Vol-1A; NAS 1.15:84877) Avail: NTIS HC A07/MF A01 CSCL 22B

Planetary and heliocentric spacecraft, including planetary flybys and probes, are described. Imaging, particles and fields, ultraviolet, infrared, radio science and celestial mechanics, atmospheres, surface chemistry, biology, and polarization are discussed. N.W.

N83-15327*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA CATALOG SERIES FOR SPACE SCIENCE AND APPLICATIONS FLIGHT MISSIONS. VOLUME 2A: DESCRIPTIONS OF GEOSTATIONARY AND HIGH-ALTITUDE SCIENTIFIC SPACECRAFT AND INVESTIGATIONS
H. Kent Hills, ed., Ronald G. Littlefield, ed., Norman J. Schofield, ed., and James I. Vetts, ed. Sep. 1982 100 p 2 Vol.
(NASA-TM-84879; NSSDC/WDC-A-R/S-82-22-Vol-2A; NAS 1.15:84879) Avail: NTIS HC A05/MF A01 CSCL 22B

Data from Earth-orbiting spacecraft at geostationary and higher altitudes was cataloged. Three lunar-orbiting spacecraft and some others whose apogees did not attain the geostationary altitude are included. S.L.

N83-15328*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LAUNCH SUMMARY FOR 1981
Robert W. Vostreys Sep. 1982 36 p refs
(NASA-TM-84881; NSSDC/WDC-A-R/S-82-24; NAS 1.15:84881) Avail: NTIS HC A03/MF A01 CSCL 22B

Launchings identified from reports received for the period January 1, 1981 through December 31, 1981 including sounding rocket, satellite and space probe launchings are summarized.N.W.

N83-15329*# Public Service Satellite Consortium, Washington, D.C.
THE EVOLUTION OF A KU-BAND SATELLITE NETWORK Final Report
Louis A. Bransford, Mary Diebler, Stephen C. Dutka, and Daniel W. Gorton Nov. 1982 90 p
(Contract NASw-3492)
(NASA-CR-169733; NAS 1.26:169733) Avail: NTIS HC A05/MF A01 CSCL 22B

The purpose of this study was to undertake the management and development of CTS terminals and time on appropriate Ku-Band satellites was procured. A community of public service users who have readily addressable needs and resources to pay for services on an ad hoc Ku-Band network was developed and a test network for selected users was managed. S.L.

N83-15330*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFRARED ASTRONOMICAL SATELLITE (IRAS) LAUNCH
[1982] 55 p
(NASA-TM-85190; E-885-83-01; NAS 1.15:85190) Avail: NTIS HC A04/MF A01 CSCL 22B

The Infrared Astronomical Satellite (IRAS) is scheduled to be launched from the Western Space and Missile Center, Vandenberg Air Force Base at Lompoc, California by a two stage Delta 3910 launch vehicle. The satellite has a design lifetime of 1 year; however, the mission lifetime is expected to be on the order of 7 months. The mission lifetime is determined by the availability of superfluid helium in the cryostat to maintain the infrared detectors at their required 3K operating temperature. The orbital lifetime of the satellite is expected to be at least 3 years before reentry will occur. The first infrared satellite mission is designed to produce an unbiased all sky survey of discrete sources in the form of sky and source catalogs using four broad photometry channels between 8 and 120 micrometers. S.L.

N83-15331# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COURSE IN METEOROLOGICAL SATELLITES: APPLICATIONS AND PHOTOINTERPRETATION, PART A [CURSO DE SATELLITES METEOROLOGICOS APLICACOES E FOTO INTERPRETATCAO PARTE A]
Fausto Carlos deAlmeida, Ricardo Negreiros dePaiva, Luiz Danielo Damasceno Ferreira, Hans Ulrich Pilchowski, Valder Matos deMedeiros, Luiz Carlos Baldicero Molion, Pedro Rubens A. Carvalho, Eduardo M. B. Alonso, Paolo Pio Camilli, and Juan Carlos Pinto deGarrido Oct. 1981 203 p refs In PORTUGUESE
(INPE-2235-MD/015) Avail: NTIS HC A10/MF A01

The first nine chapters of the course are presented. A brief history of meteorological satellites is given. The following subjects are discussed: (1) orbit estimation, (2) solar and terrestrial radiation, (3) the TIROS N, SMS, and GOES meteorological satellites and their instrumentation, (4) imaging techniques and image dissemination, (5) the ARGOS and SMS/GOES data collection platforms, (6) the UAI real time image analysis system, (7) telephonic image transmission, and (8) the operational systems and future programs of INPE. Transl. by J.D.

N83-15332# Technology Service Corp., Santa Monica, Calif.
MISSILE GUIDANCE: INTERFEROMETER HOMING USING BODY-FIXED ANTENNAS
Joseph F. Gulick and James S. Miller Laurel, Md. APL Aug. 1982 126 p refs
(Contract N00024-81-C-5301)
(AD-A119957; JHU/APL-TG-1331; TSC-W36-37) Avail: NTIS HC A07/MF A01 CSCL 17/7

Six chapters comprise this document, which is a discussion of the history and technical development of homing guidance via signals from body-fixed interferometer antennas as it is used in a tactical surface-to-air missile. Chapter 1 provides an introduction and background: Chapter 2 reviews homing guidance, giving brief consideration to the guidance technique and the concept of body-motion decoupling from the interferometer signal, as well as to the attractive features and critical factors that are characteristic of interferometers: Chapter 3 deals with early developments in interfermeter guidance; Chapter 4 presents angle-measurement techniques along with their characteristic ambiguities and the methods for resolving them, describes instrumentation techniques for phase measurement by both scanning and nonscanning systems, and discusses the effects of glint noise and multiple targets: Chapter 5 describes the methods used to decouple body motion from the interferometer signal, the effects of a nonrigid airframe, and the types of measuring instruments and their tolerances: and Chapter 6 considers the use of homing guidance for current and future missiles, its compatibility with other guidance modes for a multimode missile, and its low-frequency capability and suitability for guided projectiles. This last chapter is also directed toward the moern implementation of interferometer homing using strapdown inertial instruments and digital processing. GRA

N83-15333# Naval Surface Weapons Center, Dahlgren, Va.
CURRENT PLATE MOTIONS BASED ON DOPPLER SATELLITE OBSERVATIONS Final Report
R. J. Anderle and C. A. Malyevac Sep. 1982 106 p refs
(AD-A120534; NWSC/TR-82-369) Avail: NTIS HC A06/MF A01 CSCL 22/3

About 25 percent of the Doppler observations made on a Navy Navigation Satellite over a ten year period were analyzed to determine the motion of 10 sites on the North American plate

and 13 sites on 7 other plates. The computed plate motions were not statistically significant compared with the standard errors of measurement of 1 to 5 cm/yr except for the Australian plate and Pacific plate. The measured motions of these plates are about twice those inferred from geologic records, but are in the proper direction. The Doppler derived a cm/yr northward motion of the African plate is marginally significant; this value is also twice that inferred from geologic records, but the discrepancy is not statistically significant. Processing of the balance of the data on one satellite over the 10 year time interval would improve the accuracy of the determination by about a factor of two, improving the possibility of detecting additional statistically significant motions. Unreasonable altitude changes at most sites are probably due to neglected higher order ionospheric refraction effects on the observations. Author (GRA)

N83-15868*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
INTERACTION BETWEEN THE SPS SOLAR POWER SATELLITE SOLAR ARRAY AND THE MAGNETOSPHERIC PLASMA Final Report
John W. Freeman *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 18 p refs (For primary document see N83-15860 06-44)
(Contract NAS8-33023)
Avail: NTIS HC A99/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N83-15334*# Calspan Field Services, Inc., Arnold Air Force Station, Tenn.
WIND TUNNEL TESTS OF SPACE SHUTTLE EXTERNAL TANK INSULATION MATERIAL IN THE AEROTHERMAL TUNNEL AT ELEVATED (1440 DEG F) TOTAL TEMPERATURES Final Report, 12 Apr. - 27 Aug. 1982
A. S. Hartman and K. W. Nutt AEDC Oct. 1982 58 p refs Sponsored in part by AEDC
(NASA Order H-54986-B)
(NASA-CR-170705; NAS 1.26:170705; AEDC-TSR-V31) Avail: NTIS HC A04/MF A01 CSCL 01A

Tests of the space shuttle external tank foam insulation were conducted in the von Karman Gas Dynamics Facility Tunnel C. For these tests, Tunnel C was run at Mach 4 with a total temperature of 1440 F and a total pressure which varied from 30-100 psia. Cold wall heating rates were changed by varying the test article support wedge angle and by adding and removing a shock generator or a cylindrical protuberance. Selected results are presented to illustrate the test techniques and typical data obtained. Author

N83-15335*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACELAB MISSION 3 EXPERIMENT DESCRIPTIONS
C. Kelly Hill, ed. Nov. 1982 50 p Original contains color illustrations
(NASA-TM-82502; NAS 1.15:82502) Avail: NTIS HC A03/MF A01 CSCL 22A

The Spacelab 3 mission is the first operational flight of Spacelab aboard the shuttle transportation system. The primary objectives of this mission are to conduct application, science, and technology experimentation that requires the low gravity environment of Earth orbit and an extended duration, stable vehicle attitude with emphasis on materials processing. This document provides descriptions of the experiments to be performed during the Spacelab 3 mission. For individual titles, see N83-15336 through N83-15343.

N83-15336*# Alabama A & M Univ., Normal.
SOLUTION GROWTH OF CRYSTALS IN ZERO GRAVITY
Ravindra B. Lal *In* NASA. Marshall Space Flight Center Spacelab Mission 3 Expt. Descriptions Nov. 1982 p 3-4 (For primary document see N83-15335 06-16)
Avail: NTIS HC A03/MF A01 CSCL 22A

A series of experiments will be performed in which triglycine sulfate (TGS) crystals will be grown by a low-temperature solution growth technique in the microgravity environment of the orbital Spacelab. Triglycine sulfate (TGS) crystals will be grown in the Fluid Experiment System (FES) facility on Spacelab 3 by slowly extracting heat at a controlled rate through a seed crystal of TGS suspended on an insulated sting in a saturated solution of TGS. The FES rack assembly designed for SL-3 is shown in Figure I-1, and a detailed view of the test cell layout is presented in Figure I-2. Variations in the liquid density, solution concentration and temperature around the growing crystal will be studied using a variety of techniques, such as schlieren, shadowgraph, and interferometric measurements. Growth in Earth gravity will also be studied by the same optical techniques, and in both cases the resulting crystalline features will be compared and correlated with the growth conditions. Author

N83-15337*# Edgerton, Germeshausen and Grier, Inc., Goleta, Calif.
MERCURIC IODIDE (HgI2) GROWTH FOR NUCLEAR DETECTORS
Wayne F. Schnepple *In* NASA. Marshall Space Flight Center Spacelab Mission 3 Expt. Descriptions Nov. 1982 p 5-8 (For primary document see N83-15335 06-16)
Avail: NTIS HC A03/MF A01 CSCL 22A

The purpose of this investigation is to grow more-perfect mercuric iodide crystals in a low-gravity environment by taking advantage of diffusion-controlled growth conditions and by avoiding the problem of strain dislocations produced by the crystal's weight. This crystal has considerable practical importance as a sensitive gamma-ray detector and energy spectrometer that can operate at ambient temperature, as compared to presently available detectors that must be cooled to near liquid nitrogen temperatures. However, the performance of mercuric iodide crystals only rarely approaches the expected performance, presumably because some of the free electrical charges produced within the crystal are not collected at the electrodes, but instead remain trapped or immobilized at crystal defects. An efficient high atomic number semiconductor detector capable of operating at room temperature utilizing single HgI2 crystals offers a greater potential than existing detector technology. Author

N83-15338*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MERCURY IODIDE CRYSTAL GROWTH
R. Cadoret (Laboratoire d'Cristallographie Het et de Physique) *In its* Spacelab Mission 3 Expt. Descriptions Nov. 1982 p 9-11 (For primary document see N83-15335 06-16)
Avail: NTIS HC A03/MF A01 CSCL 22A

The purpose of the Mercury Iodide Crystal Growth (MICG) experiment is the growth of near-perfect single crystals of mercury Iodide (HgI2) in a microgravity environment which will decrease the convection effects on crystal growth. Evaporation and condensation are the only transformations involved in this experiment. To accomplish these objectives, a two-zone furnace will be used in which two sensors collect the temperature data (one in each zone). Author

N83-15339*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DYNAMICS OF ROTATING AND OSCILLATING FREE DROPS
T. G. Wang *In* NASA. Marshall Space Flight Center Spacelab Mission 3 Expt. Descriptions Nov. 1982 p 13-16 (For primary document see N83-15335 06-16)

Avail: NTIS HC A03/MF A01 CSCL 22A

The Dynamics of Rotating and Oscillating Free Drops (DROP) experiment is to be performed using the Drop Dynamics Module (DDM). The main scientific objectives of the DROP experiment are the study of the equilibrium figures of a rotating drop and the study of the large-amplitude oscillations of a liquid drop. The objective of the DROP experiment in relation to the DDM is to establish the advantages of conducting future drops and bubbles experiments in space. The DROP experiment will be subjected to continual to ensure that the experiments are scientifically current and available. The two component experiments (rotation and oscillation) of the DROP experiment have been chosen as the simplest experiments representative of the entire class of drop dynamics experiments. The component experiment on the equilibrium shapes of a rotating liquid drop of a simple liquid is not only an important and interesting experiment in its own right, but is also the simplest gyrostatic experiment that can be performed. In later experiments, more complicated liquids can be used; bubbles can be included; and the dynamics of rotating drops can be studied. This experiment, as it now stands, is an important exercise of the module's ability to provide drop rotation and the requisite science data. Author

N83-15340*# Colorado Univ., Boulder.
GEOPHYSICAL FLUID FLOW CELL EXPERIMENT
John E. Hart *In* NASA. Marshall Space Flight Center Spacelab Mission 3 Expt. Descriptions Nov. 1982 p 17-19 (For primary document see N83-15335 06-16)
Avail: NTIS HC A03/MF A01 CSCL 22A

The primary purpose of the geophysical flow experiments is to simulate large-scale baroclinic (density-stratified) flows which occur naturally in the atmospheres of rotating planets and stars and to gain insights and obtain answers to crucial questions concerning the large-scale nonlinear mechanics of the global geophysical flows. Those external conditions related to fluid viscosity, rotation, gravity are identified, which allow qualitatively different modes of instability or waves in the model. Author

N83-15341*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AMES RESEARCH CENTER LIFE SCIENCES PAYLOAD
Paul X. Callahan and John W. Tremor *In* NASA. Marshall Space Flight Center Spacelab Mission 3 Expt. Descriptions Nov. 1982 p 21-26 (For primary document see N83-15335 06-16)
Avail: NTIS HC A03/MF A01 CSCL 22A

In response to a recognized need for an in-flight animal housing facility to support Spacelab life sciences investigators, a rack and system compatible Research Animal Holding Facility (RAHF) has been developed. A series of ground tests is planned to insure its satisfactory performance under certain simulated conditions of flight exposure and use. However, even under the best conditions of simulation, confidence gained in ground testing will not approach that resulting from actual spaceflight operation. The Spacelab Mission 3 provides an opportunity to perform an inflight Verification Test (VT) of the RAHF. Lessons learned from the RAHF-VT and baseline performance data will be invaluable in preparation for subsequent dedicated life sciences missions. Author

N83-15342*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ATMOSPHERIC TRACE MOLECULE SPECTROSCOPY
C. B. Farmer *In* NASA. Marshall Space Flight Center Spacelab Mission 3 Expt. Descriptions Nov. 1982 p 29-33 (For primary document see N83-15335 06-16)
Avail: NTIS HC A03/MF A01 CSCL 22A

The Spacelab investigation entitled Atmospheric Trace Molecule Spectroscopy (ATMOS) is designed to obtain fundamental information related to the chemistry and physics of the Earth's upper atmosphere using the techniques of infrared absorption spectroscopy. There are two principal objectives to be met. The first is the determination, on a global scale, of the compositional structure of the upper atmosphere and its spatial variability. The establishment of this variability represents the first step toward determining the characteristic residence times for the upper atmospheric constituents; the magnitudes of their sources and sinks; and, ultimately, an understanding of their effects on the stability of the stratosphere. The second objective is to provide the high-resolution, calibrated spectral information which is essential for the detailed design of advanced instrumentation for subsequent global monitoring of specific species found to be critical to atmospheric stability. This information will be disseminated in the form of a three dimensional atlas of solar absorption spectra obtained over a range of latitudes, longitudes, and altitudes. Author

N83-15343*# Tata Energy Research Inst., Bombay (India).
STUDIES OF THE IONIZATION STATES OF SOLAR AND GALACTIC COSMIC RAY HEAVY NUCLEI
S. Biswas *In* NASA. Marshall Space Flight Center Spacelab Mission 3 Expt. Descriptions Nov. 1982 p 35-37 (For primary document see N83-15335 06-16)
Avail: NTIS HC A03/MF a01 CSCL 22A

Enhancement of abundances of heavy nuclei (e.g., Mg, Si, and Fe) at low energies relative to solar photospheric abundances and anomalously high abundances of iron relative to oxygen nuclei at low energies were recently discovered in solar energetic particles studied at low energy. These phenomena are not understood at present. The proposed experiment is designed to study the recently discovered anomalous component of low energy galactic cosmic ray ions of C, N, O, Ne, and Ca to Fe of energy 5- to 10-million electron volts per atomic mass unit in regard to their ionization states, composition, and intensity, and to study the ionization states of heavy elements from oxygen to iron in energetic solar particles emitted during flare events. The same detector system will serve for both studies, with the second objective being given priority if there are any solar particle events during the mission. Author

N83-15344*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA ANNOUNCEMENT BULLETIN: SPACE SHUTTLE OSTA 1 PAYLOAD DATA
Nov. 1982 2 p
(NASA-TM-84884; NSSDC/WDC-A-R/S-82-25; NAS 1.15:84884)
Avail: NTIS HC A02/MF A01 CSCL 12A

Data from the scientific payload, OSTA 1, is available. Images of the Earth's surface taken from the Shuttle Imaging Radar-A were processed, and can be obtained in the form of photographic prints, negatives, or positive transparencies. Magnetic tapes containing data for the ocean color experiment and the Shuttle multispectral infrared radiometer are also available. S.L.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N83-15345*# Public Service Satellite Consortium, Denver, Colo.
AN OVERVIEW OF THE COMMUNICATIONS TECHNOLOGY SATELLITE (CTS) PROJECT Final Report
William Rapp, Dail Ogden, and Darcy Wright Washington NASA Dec. 1982 299 p
(Contract NAS5-25005)
(NASA-CR-165532; NAS 1.26:165532) Avail: NTIS HC A13/MF A01 CSCL 09F

The Communications Technology Satellite (CTS) project is reviewed. A technical description of the CTS spacecraft and its cognate hardware and operations is included. A historical treatise of the CTS project is provided. Also presented is an overview of the CTS experiments and demonstrations conducted during the course of the project. Author

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N83-15346*# Vought Corp., Dallas, Tex.
DEVELOPMENT OF DEPLOYABLE STRUCTURES FOR LARGE SPACE PLATFORM SYSTEMS, PART 1 Interim Report, 29 Oct. 1981 - 31 Jul. 1982
R. L. Cox and R. A. Nelson 25 Oct. 1982 209 p refs
(Contract NAS8-34678)
(NASA-CR-170690; NAS 1.26:170690;
Rept-2-32300/2R-53215-Pt-1) Avail: NTIS HC A10/MF A01 CSCL 22B

Eight deployable platform design objectives were established: autodeploy/retract; fully integrated utilities; configuration variability; versatile payload and subsystem interfaces; structural and packing efficiency; 1986 technology readiness; minimum EVA/RMS; and Shuttle operational compatibility. N.W.

N83-15347# Naval Research Lab., Washington, D. C.
DO TRAPPED HEAVY IONS CAUSE SOFT UPSETS ON SPACECRAFT? Final Report
J. H. Adams, Jr. and K. Partridge 12 Oct. 1982 31 p refs
(AD-A119909; NRL-MR-4846) Avail: NTIS HC A03/MF A01 CSCL 04/1

It has recently been recognized that single intensely-ionizing particles can cause soft upsets in microelectronic components used in spacecraft. These particles can be heavy ions in galactic cosmic rays or heavy ions accelerated in solar flares. When the upsets are due to the trapped radiation, they are thought to result from nuclear interactions initiated by trapped protons. In this report, we have investigated whether there are sufficient numbers of heavy ions trapped in the Van Allen belts to be the dominant cause of soft upsets. We conclude, based on the scanty data available, that the contribution from upsets caused by trapped heavy ions is likely to be important at least under some conditions. We also found that we could not rule out the possibility that trapped heavy ions may cause upset rates that are orders of magnitude larger than those predicted from the trapped proton population.
Author (GRA)

N83-15882*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MATERIALS TECHNOLOGY FOR LARGE SPACE STRUCTURES Final Report
Charles P. Blankenship and Darrel R. Tenney *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 38 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

N83-15348*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCED AUTOMATION FOR SPACE MISSIONS Final Report
Robert A. Freitas, Jr., ed. (Santa Clara Univ.) and William P. Gilbreath, ed. Nov. 1982 392 p refs Meeting held in Santa Clara, Calif., 23 Jun. - 29 Aug. 1980; sponsored in cooperation with Am. Soc. for Eng. Education Previously announced as A82-29251 Original contains color illustrations
(NASA-CP-2255; A-8618; NAS 1.55:2255) Avail: NTIS HC A17/MF A01 CSCL 22B

The feasibility of using machine intelligence, including automation and robotics, in future space missions was studied. For individual titles, see N83-15349 through N83-15354.

N83-15349*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TERRESTRIAL APPLICATIONS: AN INTELLIGENT EARTH-SENSING INFORMATION SYSTEM
In its Advan. Automation for Space Missions Nov. 1982 p 11-38 refs Document previously announced as A82-22149 (For primary document see N83-15348 06-19)
Avail: NTIS HC A17/MF A01 CSCL 22B
For Abstract see A82-22149.

N83-15350*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE EXPLORATION: THE INTERSTELLAR GOAL AND TITAN DEMONSTRATION
In its Advan. Automation for Space Missions Nov. 1982 p 39-76 refs (For primary document see N83-15348 06-19)
Avail: NTIS HC A17/MF A01 CSCL 22B

Automated interstellar space exploration is reviewed. The Titan demonstration mission is discussed. Remote sensing and automated modeling are considered. Nuclear electric populsion, main orbiting spacecraft, lander/rover, subsatellites, atmospheric probes, powered air vehicles, and a surface science network comprise mission component concepts. Machine, intelligence in space exploration is discussed. N.W.

N83-15351*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NONTERRESTRIAL UTILIZATION OF MATERIALS: AUTOMATED SPACE MANUFACTURING FACILITY
In its Advan. Automation for Space Missions Nov. 1982 p 77-188 refs (For primary document see N83-15348 06-19)
Avail: NTIS HC A17/MF A01 CSCL 22B

Four areas related to the nonterrestrial use of materials are included: (1) material resources needed for feedstock in an orbital manufacturing facility, (2) required initial components of a nonterrestrial manufacturing facility, (3) growth and productive capability of such a facility, and (4) automation and robotics requirements of the facility. Author

N83-15352*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REPLICATING SYSTEMS CONCEPTS: SELF-REPLICATING LUNAR FACTORY AND DEMONSTRATION
In its Advan. Automation for Space Missions Nov. 1982 p 189-335 refs (For primary document see N83-15348 06-19)
Avail: NTIS HC A17/MF A01 CSCL 22B

Automation of lunar mining and manufacturing facility maintenance and repair is addressed. Designing the factory as an automated, multiproduct, remotely controlled, reprogrammable Lunar Manufacturing Facility capable of constructing duplicates of itself which would themselves be capable of further replication is proposed. Author

N83-15353*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TECHNOLOGY ASSESSMENT OF ADVANCED AUTOMATION FOR SPACE MISSIONS
In its Advan. Automation for Space Missions Nov. 1982 p 337-372 refs (For primary document see N83-15348 06-19)
Avail: NTIS HC A17/MF A01 CSCL 22B

Six general classes of technology requirements derived during the mission definition phase of the study were identified as having maximum importance and urgency, including autonomous world model based information systems, learning and hypothesis formation, natural language and other man-machine communica-

tion, space manufacturing, teleoperators and robot systems, and computer science and technology. Author

N83-15354*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONCLUSIONS AND IMPLICATIONS OF AUTOMATION IN SPACE
In its Advan. Automation for Space Missions Nov. 1982 p 373-381 refs (For primary document see N83-15348 06-19)
Avail: NTIS HC A17/MF A01 CSCL 22B

Space facilities and programs are reviewed. Space program planning is discussed. Author

N83-15355# Air Force Geophysics Lab., Hanscom AFB, Mass. Aeronomy Div.
APPLICATION OF THE SATELLITE TRIAXIAL ACCELEROMETER EXPERIMENT TO ATMOSPHERIC DENSITY AND WIND STUDIES Interim Scientific Report
Frank A. Marcos and Everett R. Swift (Naval Surface Weapons Center, Dahlgren, Va.) 4 Mar. 1982 54 p refs
(AD-A120852; AFGL-ERP-774) Avail: NTIS HC A04/MF A01 CSCL 22/3

A new satellite triaxial accelerometer system has been developed. This instrument has been flight-tested on three-axis stabilized satellites and has demonstrated the capability to accurately measure accelerations in the satellite's in-track, cross-track, and radial directions. The in-track data provide direct determination of atmospheric density. These data, obtained during a period of high solar flux, supplement the extensive set of measurements obtained by other accelerometer experiments during low solar flux conditions. The cross-track and radial results permit, for the first time, large-scale measurements of the zonal and, possibly, radial components of neutral atmospheric winds. These simultaneous wind and density data provide an extremely valuable input for the understanding of dynamic processes in the atmosphere and for the improvement of atmospheric models.
Author (GRA)

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N83-15356# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE WAY TO SPACE
Yiyun Zhou and Ruichen Li 1 Sep. 1982 13 p Transl. into ENGLISH from Hangkong Zhishi (China), Feb. 1982 p 20-22
(AD-A119842; FTD-ID(RS)T-0516-82) Avail: NTIS HC A02/MF A01 CSCL 21/8

Liquid propellant rocket engines are discussed. Their characteristics and improvements are considered. S.L.

N83-15843# Air Force Office of Scientific Research, Bolling AFB, Washington, D.C. Aerospace Sciences Directorate.
POWER REQUIREMENTS FOR ORBIT RAISING PROPULSION
Leonard H. Caveny *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 15 p refs (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 21/8

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N83-15357# State Univ. of New York, Buffalo. Dept. of Chemistry.
TRANSITION METAL COMPLEXES OF ORGANOALUMINUM PHOSPHIDES: THE SYNTHESIS, CHARACTERIZATION AND CRYSTAL AND MOLECULAR STRUCTURE OF Cr(CO)5(PPh2Al(CH2SiMe3)2.NMe3)
Claire Tessier-Youngs, Clifford Bueno, O. T. Beachley, Jr., and Melvyn Rowen Chruchill 20 Oct. 1982 36 p refs Submitted for publication
(Contract N00014-78-C-0562; Grant NSF CHE-80-23448; NR Proj. 053-628)
(AD-A120680; TR-9) Avail: NTIS HC A03/MF A01 CSCL 07/3

The reactions of organoaluminum phosphides with a variety of transition metal carbonyl complexes containing labile ligands have been investigated. The reaction of Cr(CO)5NMe3 with (Me3SiCH2)(2AlPh2) in benzene solution leads to the formation of Cr(CO)5(PPh2Al(CH2SiMe3)2. NMe3), a fully characterized new compound. An X-ray structural study has identified discrete isolated molecules. Diffraction data were collected with a Syntex P2 sub 1 diffractometer and the structure was refined to R sub F = 6.4% for all 4948 reflections. There are no abnormally short intermolecular contacts. The unusual features identified in the investigation are the long bond distances for Al-P of 2.485(1)A and Cr-P of 2.482(1)A. The Al-N bond seems to be normal. The geometry about the tetrahedrally coordinated phosphorus atom is decidely irregular. Similarily, the aluminum atom has a rather distorted tetrahedral environment. GRA

N83-15358# General Electric Co., Schenectady, N. Y. Energy Systems Program Dept.
LONG TERM MATERIALS TEST PROGRAM MATERIALS EVALUATION, IMPROVED SIMULATION TESTS
Jul. 1981 52 p refs
(Contract DE-AC21-79ET-15457)
(DE82-002988; DOE/ET-15457-22) Avail: NTIS HC A04/MF A01

The screening/simulation testing of gas turbine engine materials is discussed. In the small burner rig tests the pressurized fluidized bed (PFB) particulate did not cause hot corrosion/sulfidation of the gas turbine in the absence of additional corrosion contaminants. In the presence of a high concentration of alkali sulfate condensate, the flyash appears to inhibit hot corrosion attack. In the erosion/corrosion simulator tests the PFB combined cycle particulate alone caused hot corrosion/sulfidation of IN-738 even in the absence of any additional corrosion contaminants. This occurrence of sulfide formation in the high velocity (960 to 1170 ft/s) simulator testing but not in the flow velocity (90 ft/s) burner rig testing may be related to the oxide stability on the material surfaces. The high-temperature gas turbine alloys develop their corrosion resistance through the formation of protective oxide (Al2O3, Cr2O3) layers. The high velocity impingement of particulate causes exfoliation/spalling of these protective oxides. The M(Co,Fe)CrAlY materials appear to be completely adequate for the PFB environment. DOE

24 COMPOSITE MATERIALS

Includes laminates.

N83-15359*# Delaware Univ., Newark. Center for Composite Materials.
STRENGTH AND MECHANICS OF BONDED SCARF JOINTS FOR REPAIR OF COMPOSITE MATERIALS Final Report, Jun. 1981 - May 1982
R. Byron Pipes and David W. Adkins Dec. 1982 190 p refs
(Grant NsG-1304)
(NASA-CR-169708; NAS 1.26:169708; CCM-82-14) Avail: NTIS HC A09/MF A01 CSCL 11D

Experimental and analytical investigations of scarf joints indicate that slight bluntness of adherend tips induces adhesive stress concentrations which significantly reduce joint strength, and

the stress distribution through the adhesive thickness is non-uniform and has significant stress concentrations at the ends of the joint. The laminate stacking sequence can have important effects on the adhesive stress distribution. A significant improvement in joint strength is possible by increasing overlap at the expense of raising the repair slightly above the original surface. Although a surface grinder was used to make most experimental specimens, a hand held rotary bur can make a surprisingly good scarf. Scarf joints wit doublers on one side, such as might be used for repair, bend under tensile loads and may actually be weaker than joints without doublers. A.R.H.

N83-15360*# Aerojet Liquid Rocket Co., Sacramento, Calif.
COMPOSITE MATERIAL APPLICATION TO LIQUID ROCKET ENGINES Final Report
D. C. Judd Dec. 1982 314 p refs
(Contract NAS8-34623)
(NASA-CR-170697; NAS 1.26:170697; Rept-2418-F) Avail: NTIS HC A14/MF A01 CSCL 11D

The substitution of reinforced plastic composite (RPC) materials for metal was studied. The major objectives were to: (1) determine the extent to which composite materials can be beneficially used in liquid rocket engines; (2) identify additional technology requirements; and (3) determine those areas which have the greatest potential for return. Weight savings, fabrication costs, performance, life, and maintainability factors were considered. Two baseline designs, representative of Earth to orbit and orbit to orbit engine systems, were selected. Weight savings are found to be possible for selected components with the substitution of materials for metal. Various technology needs are identified before RPC material can be used in rocket engine applications. E.A.K.

N83-15361*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STRESS ANALYSIS OF ADVANCED ATTACK HELICOPTER COMPOSITE MAIN ROTOR BLADE ROOT END LUG
Donald J. Baker (Army Aviation Research and Development Command, Hampton, Va.) Dec. 1982 25 p refs
(NASA-TM-84578; NAS 1.15:84578) Avail: NTIS HC A02/MF A01 CSCL 11D

Stress analysis of the Advanced Attack Helicopter (AAH) composite main rotor blade root end lug is described. The stress concentration factor determined from a finite element analysis is compared to an empirical value used in the lug design. The analysis and test data indicate that the stress concentration is primarily a function of configuration and independent of the range of material properties typical of Kevlar-49/epoxy and glass epoxy. S.L.

N83-15362*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYGROTHERMOMECHANICAL EVALUATION OF TRANSVERSE FILAMENT TAPE EPOXY/POLYESTER FIBERGLASS COMPOSITES
R. L. Lark and C. C. Chamis 1983 24 p refs Proposed for presentation at the 38th Ann. Conf. of the Society of Plastics Industry (SPI) Reinforced Plastics/Composites Inst., Houston, Tex., 7-11 Feb. 1983
(NASA-TM-83044; E-1491; NAS 1.15:83044) Avail: NTIS HC A02/MF A01 CSCL 11D

The static and cyclic load behavior of transverse filament tape (TFT) fiberglass/epoxy and TFY fiberglass/polyester composites, intended for use in the design of low-cost wind turbine blades, are presented. The data behavior is also evaluated with respect to predicted properties based on an integrated hygrothermomechanical response theory. Experimental TFT composite data were developed by the testing of laminates made by using composite layups typical of those used for the fabrication of TFT fiberglass wind turbine blades. Static properties include tension, compression, and interlaminar shear strengths at ambient conditions and at high humidity/elevated temperature conditions after a 500 hour exposure. Cyclic fatigue data were obtained using similar environmental conditions and a range of cyclic stresses. The environmental (temperature and moisture) and cyclic load effects on composite strength degradation are subsequently compared with the predictions obtained by using the composite life/durability theory. The results obtained show that the predicted hygrothermomechanical environmental effects on TFT composites are in good agreement with measured data for various properties including fatigue at different cyclic stresses. S.L.

N83-15363*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC MECHANICAL PROPERTIES OF N-PHENYLNADIMIDE MODIFIED PMR POLYIMIDE COMPOSITES
Ruth H. Pater 1983 9 p refs Proposed for presentation at the 185th Natl. Meeting of the Am. Chem. Soc., Seattle, 20-25 Mar. 1983
(NASA-TM-83051; E-1505; NAS 1.15:83051) Avail: NTIS HC A02/MF A01 CSCL 11D

The rheological behavior of newly developd Celion 6000/N-phenylnadimide modified PMR polyimide and PMR-15 composites was investigated. The dynamic mechanical properties were correlated with the structure of N-phenylnadimide modified PMR polyimides. The storage modulus (G'), loss modulus (G''), and loss tangent (tan delta) of four composite systems were measured over a temperature range from -150 to 400 C. Three well defined peaks were seen in the regions of 360, 100, and -120 C, corresponding to the alpha, beta, and gamma relaxations, respectively, of the matrix resins. The activation energies of the alpha, beta, and gamma relaxations were estimated to be 232, 60, and 14 kcal/mole, respectively, for PMR-15. Addition of N-phenylnadimide to the PMR-15 composition lowered the glass transition temperature and the activation energies of PMR-15 polyimide. The dynamic mechanical data appear to be consistent with the formation of a copolymer from N-phenylnadimide and a PMR-15 prepolymer. S.L.

N83-15364*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PMR POLYIMIDE COMPOSITES FOR AEROSPACE APPLICATIONS
Tito T. Serafini 1982 22 p refs Presented at the 1st Tech. Conf. on Polyimides, Ellenville, N.Y., 10-12 Nov. 1982; sponsored by the Society of Plastics Engineers, Inc.
(NASA-TM-83047; E-1494; NAS 1.15:83047) Avail: NTIS HC A02/MF A01 CSCL 11D

Fiber reinforced PMR polyimides are finding increased acceptance as engineering materials for high performance structural applications. Prepreg materials based on this novel class of highly processable, high temperature resistant polyimides, are commercially available and the PMR concept was incorporated in several industrial applications. The status of PMR polyimides is reviewed. Emphasis is given to the chemistry, processing, and applications of the first generation PMR polyimides known as PMR-15. S.L.

N83-15365*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE 371 DEG C(700 DEG F) PROPERTIES OF CELION 6000/N-PHENYLNADIMIDE MODIFIED PMR POLYIMIDE COMPOSITES
Ruth H. Pater 1982 12 p refs Presented at the Natl. Tech. conf. of the Society of Plastics Engineers, Bal Harbour, Fla., 25-27 Oct. 1982
(NASA-TM-83050; E-1504; NAS 1.15:83050) Avail: NTIS HC A02/MF A01 CSCL 11D

The 371 C (700 F) properties of Celion 6000/N-phenylnadimide modified PMR-15 polyimide composites were investigated to determine the feasibility of using these materials at a 371 C (700 F) service temperature. The processing characteristics and physical and mechanical properties of the composite systems are presented. The results of the 371 C (700 F) thermo-oxidation stability study suggest that the composite materials can be considered for short term (at least 100 hours) application at 371 C (700 F). S.L.

N83-15366# IIT Research Inst., Chicago, Ill.
NONDESTRUCTIVE EVALUATION OF METAL MATRIX COMPOSITES Final Report, 1 Oct. 1980 - 31 Dec. 1981
S. W. Schramm and I. M. Daniel Watertown, Mass. Army Materials and Mechanics Research Center May 1982 141 p refs
(Contract DAAG46-80-C-0070; DA Proj. 1L2-63102-D-071)
(AD-A119996; AMMRC-TR-82-35; IITRI-M06084-14) Avail: NTIS HC A07/MF A01 CSCL 11/4

The objective of the program was to apply nondestructive evaluation (NDE) methos to assess the integrity of FP/magnesium commposites. The material investigated was ZE41A magnesium alloy reinforced with FP (aluminum oxide) fibers. The 21 specimens were evaluated using ultrasonic scanning, wave propagation velocity, wave attenuation, and X-ray radiograph inspection techniques. After the NDE inspections were completed, a representative specimen from each of the seven groups was sectioned and micrographs were made for comparison with the NDE records. It was found that ultrasonic scanning using a 15 MHz compression wave, focused transducers operated in the pulse-echo mode generating an analog C-scan gave the best results. The wave attenuation and wave propagation velocity measurements were found to be very consistent with the ultrasonic C-scans, but X-ray radiography was useful only at locations of gross material defect. GRA

N83-15367# Northwestern Univ., Evanston, Ill.
DYNAMICS OF COMPOSITE MATERIALS AND ELASTIC STRUCTURAL ELEMENTS WITH VARIABLE DIMENSIONS Final Report, 21 Sep. 1979 - 31 Mar. 1982
S. Nemat-Nasser Sep. 1982 10 p refs
(Contract DAAG29-79-C-0168)
(AD-A119918; ARO-15872.12-EG) Avail: NTIS HC A02/MF A01 CSCL 11/4

The project was concerned with the development and exploitation of new methodologies for an effective and accurate calculation of the dynamic response and overall properties of elastic composites with periodic structures, and vibration of elastic structural components which have relatively large variations in their stiffness, mass distribution, and/or dimensions. The work accomplished is in the areas of waves in layered and fiber-reinforced anisotropic elastic composites, stability and dynamic response of rotating blades; and overall properties of composites with periodic structures. The results have been reported in nine papers, which have been (or will be) published in the scientific literature. GRA

N83-15368# Oak Ridge National Lab., Tenn.
IMPROVED TECHNIQUES FOR THE ULTRASONIC CHARACTERIZATION OF GRAPHITE
K. V. Cook and W. A. Simpson 1981 6 p refs Presented at ASNT Fall Conf., Atlanta, 12 Oct. 1981
(Contract W-7405-eng-26)
(DE82-001463; CONF-811003-5) Avail: NTIS HC A02/MF A01

Near-conventional pulse-echo flaw detection techniques can be successfully applied to graphite material. It the spcimen configuration (i.e., length-to-diameter ratio) is conducive to the choice of ultrasonic test parameters dictated by the material screening tests, then only the test sensitivity needs to be established. Conventional test block approaches to calibration work well; however, uniform homogeneity of the specimens to be tested must be assumed (depending on the graphite, this may be an invalid assumption). Sensitivities that we have demonstrated typically detect 0.5 to 0.75 mm (0.020 to 0.030 in.) reflectors at depths up to 102 mm (4 in.) for GRAPHNOL (drilled holes, not flat bottom). Other materials may dictate inspection for much larger discontinuities. The least sensitive tests performed to date (using the storage oscilloscope approach) required flat-bottom holes of 6.35 mm (0.250 in.) in diameter for calibration. This relatively insensitive test was necessary because of the billet length and material characteristics. DOE

N83-15369# Los Alamos Scientific Lab., N. Mex.
CHARACTERIZATION OF ALUMINUM/ALUMINUM NITRIDE COATINGS SPUTTER DEPOSITED USING THE PULSED-GAS PROCESS
R. W. Springer and C. D. Hosford 1981 16 p refs Presented at the Am. Vacuum Soc. Nat. Symp., Anaheim, Calif., 2-6 Nov. 1981
(Contract W-7405-eng-36)
(DE82-002325; LA-UR-81-3157; CONF-811113-27) Avail: NTIS HC A02/MF A01

A dc triode magnetron was used to produce freestanding Al/Al + AlN lamellar foils by sputter deposition. The 5 micron thick foils produced on both flat substrates as well as curved substrates exhibited good specularity as well as excellent mechanical properties. The pulse spacing was varied from none to 100-nm spacing. The yield strength of the material was found to obey the Hall-Petch relation sigma sub ys = 230 + .07 d sup 1/2, where sigma sub ys is in MPa. Auger electron spectroscopy and secondary ion mass spectroscopy indicate that the large flow stress of 230 MPa must be due to grain refinement of the extended source and not an impurity effect. The result is that limitations of masking found in uniaxial flux sources for curved surfaces can be removed allowing the high quality coating of more general shapes. DOE

N83-15370# Massachusetts Inst. of Tech., Cambridge. Nuclear Reactor Lab.
BEHAVIOR OF BORON COATING UNDER SIMULTANEOUS ION BOMBARDMENT AND TEMPERATURE CYCLING
H. Anderson, S. G. DiPietro, G. Kohse, and O. K. Harling 1981 5 p refs Presented at the Fusion Reactor Mater. Meeting, Seattle, 9 Aug. 1981
(Contract DE-AS02-78ET-52027)
(DE82-000660; DOE/ET-52027/3; CONF-810831-58) Avail: NTIS HC A02/MF A01

Low Z boron coatings have been tested for stability under simulated fusion reactor conditions including simultaneous temperature cycling and ion implantition from the 10B (n,a)7Li reaction. Boron coatings several microns thick, produced by vacuum evaporation onto heated titanium substrates, exhibited reasonable stability after doses of 3.8 x 10 to the 18th power alpha/sq cm and 1320 temperature cycles from 165 to 490 C. These conditions correspond to exposures at the first wall of the fusion reactor, ranging from a few weeks to about 6 months, depending on the reactor design. DOE

N83-15371# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.
THE STABILITY OF TRANSVERSE CRACKS IN FIBRE COMPOSITES
D. C. Phillips and G. M. Wells Feb. 1982 11 p refs
(AERE-R-10482) Avail: NTIS HC A02/MF A01

The failure of fibre composite laminates is frequently controlled by the propagation parallel to fibers of interlaminar and intralaminar cracks. The fracture energy (G) of a crack propagating prallel to fibers increases with crack length (a) due to the development of a tied zone bridging the crack faces. This increase in fracture energy influences the stability of the crack. Cracks less than a critical size are unstable, propagating catastrophically when the critical stress is reached; cracks greater than the critical size are stable, and can only grow with increasing load beyond the critical stress. The condition for the transition from stability to instability is (dG)/da < (G)/a. Fracture energy measurements which only measure the average energy for propagation do not provide sufficient information about the stability of a flaw. More detailed measurements of the initial (G sub o) and ultimate (G sub u) energies and (dG)/da are required, and are necessary to assess the effectiveness of matrix toughening mechanisms. Author

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N83-15372*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT AND EVALUATION OF POLYVINYL-ALCOHOL BLEND POLYMER FILMS AS BATTERY SEPARATORS
Michelle A. Manzo Dec. 1982 25 p refs
(NASA-TM-82981; E-1412; NAS 1.15:82981) Avail: NTIS HC A02/MF A01 CSCL 10C

Several dialdehydes and epoxies were evaluated for their suitability as cross-linkers. Optium concentrations of several cross-linking reagents were determined. A two-step method of cross-linking, which involves treatment of the film in an acid or acid periodate bath, was investigated and dropped in favor of a one-step method in which the acid catalyst, which initiates cross-linking, is added to the PVA - cross-linker solution before casting. The cross-linking was thus achieved during the drying step. This one-step method was much more adaptable to commercial processing. Cross-linked films were characterized as alkaline battery separators. Films were prepared in the lab and tested in cells in order to evaluate the effect of film composition and a number of processing parameters on cell performance. These tests were conducted in order to provide a broader data base from which to select optimum processing parameters. Results of the separator screening tests and the cell tests are discussed.
M.G.

N83-15373# Little (Arthur D.), Inc., Cambridge, Mass.
SURFACE SAMPLING TECHNIQUES, VOLUME 1 Final Report
Bruce E. Goodwin, James R. Aronson, Robert P. ONeil, Margaret A. Randel, and Emmett A. Smith Sep. 1982 94 p refs
(Contract DAAK11-81-C-0014)
(AD-A120857; DRXTH-TE-CR-82179-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 19/1

This study resulted in the development of several methods for the sampling and analysis of explosives/explosive residues on building materials surfaces. A method for qualitative determination based on detection of charge-transfer complexes formed between the explosive/explosive residue and a visualization reagent applied to the surface has been evaluated in the field at two Army Ammunition Plants. A method for quantitative determination based on solvent extraction of samples collected in the field followed by high pressure liquid chromatographic analysis has been evaluated on samples prepared in the laboratory, and found to give promising results. The theoretical and practical feasibility of another method for qualitative determination based on UV irradiation of a suspected contaminated surface with subsequent detection of any explosives/explosive residues present has been demonstrated. This approach may provide the means for 'scanning' an area to determine whether explosives are present on a real-time basis. Further development of this approach is recommended. GRA

N83-15374# Rome Air Development Center, Griffiss AFB, N.Y. Solid State Sciences Div.
LOW PRESSURE SYNTHESIS OF INDIUM PHOSPHIDE
Joseph A. Adamski Apr. 1982 23 p refs
(AF Proj. 2306)
(AD-A120855; RADC-TR-82-104) Avail: NTIS HC A02/MF A01 CSCL 07/3

Polycrystalline large grain ingots of indium phosphide have been synthesized using the direct reaction technique. Indium phosphide has been grown under various phosphorus pressures (3 to 30 atm). Several temperature profiles were used to study the effect of temperature on mobility, carrier concentrations, grain size, homogeneity, and stoichiometry. Quartz and pyrolytic boron nitride boats are used. Several experiments were performed placing the PBN and quartz boats inside boron nitride and aluminum oxide tubes in an attempt to lower the silicon contamination. Data are presented. showing the results of different profiles, phosphorus pressures, and boat-tube materials. Author (GRA)

N83-15375# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
INFRARED LUMINESCENCE OF CHEMI- AND PHOTON-ACTIVATED MOLECULES Final Report, 1 Nov. 1979 - 30 Jun. 1982
J. I. Steinfeld 1 Sep. 1982 36 p refs
(Contract F19628-80-C-0028; AF Proj. 2310)
(AD-A120840; AFGL-TR-82-0267) Avail: NTIS HC A03/MF A01 CSCL 07/4

Research was performed on the following: (1) vibrational energy transfer in ozone by infrared-ultraviolet double resonance; (2) sum rules for continuous molecular electronic spectra; (3) ultraviolet continuum spectroscopy of vibrationally excited ozone; (4) Coherent Anti-Stokes Raman detection of ozone in vibrationally excited states; (5) infrared emission and absorption strengths in 14N15N.
GRA

N83-15376# Little (Arthur D.), Inc., Cambridge, Mass.
SURFACE SAMPLING TECHNIQUES. VOLUME 2: CERTIFICATION TESTING DATA Final Report
Bruce E. Goodwin, James R. Aronson, Robert P. O'Neil, Margaret A. Randel, and Emmett M. Smith Sep. 1982 359 p 2 Vol.
(AD-A120835; DRXTH-TE-CR-82179-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 19/1

Semiquantitative certification data are presented for surface sampling techniques. Tables for quantitative determination of DNP, RDX, TNB, 2, 6-DNT on surfaces are given. S.L.

N83-15377# Colorado State Univ., Fort Collins. Dept. of Chemistry.
TEMPERATURE DEPENDENCE OF THE FLUORESCENCE LIFETIME OF BENZENE IN CRYOGENIC SOLUTIONS
F. Li, J. Lee, and E. R. Bernstein 28 Sep. 1982 37 p refs
(Contract N00014-79-C-0647)
(AD-A119858; TR-8) Avail: NTIS HC A03/MF A01 CSCL 20/6

Fluorescence lifetimes for C6D6 in various hydrocarbon solvents have been measured as a function of concentration and temperature. For the solvents ethylene, ethane andpropane, it is found that at low concentrations (about 0.3 ppm or aboyt 4 x 10 to the minus 6th power mole/alpha) the fluorescence lifetime is roughly temperature independent (90 < or T < or 200K) and equal to the gas phase value of about 150ns. As the concentration is increased (1 < or = c < or = 100 ppm) the lifetime decreases as temperature is increased reaching a minimum valueat about 150K of roughly 70-100 nsec, depending on the concentration.As the temperature is increased from 150K to 220K, the lifetime increases to well over 100ns. These trends can be understood on the basis of a monomer/excimer kinetic model in which benzene excimers form at low temperature and break apart at high temperature to regenerate the excited state and state monomers. In propene and 1-butene solvents, such behavior is not observed most likely due to solvent triplet state quenching of the excited 1B2u benzene monomer. GRA

N83-15378# Columbia Univ., New York. Radiation Lab.
SPECTROSCOPY, RELAXATION AND EXCITATION TRANSFER OF OPTICALLY EXCITED STATES IN SOLIDS Final Report, 1 Aug. 1980 - 31 Jul. 1982
Sven R. Hartmann Oct. 1982 29 p refs Sponsored in part by Army
(Grant NSF DMR-80-06966)
(AD-A120386; ARO-17379.2-PH) Avail: NTIS HC A03/MF A01 CSCL 20/10

The central focus of the research performed under this contract involved the optical 3H4 - 1D2 transition of the Pr3+ ion in LaF3. In addition to this transition, a theoretical analysis of propagation narrowing in the transmission of a light pulse through a spectral hole was performed. GRA

N83-15379# Indiana Univ., Bloomington. Dept. of Chemistry.
REPLACEMENT ION CHROMATOGRAPHY WITH FLAME PHOTOMETRIC DETECTION. 1: CATIONS
S. W. Downey and G. M. Hieftje 27 Sep. 1982 20 p refs Submitted for publication
(Contract N00014-76-C-0838)
(AD-A120082; INDU/DC/GMH/TR-82-48) Avail: NTIS HC A02/MF A01 CSCL 07/4

Replacement Ion Chromatography (RIC) is a new detection scheme for ion chromatography with the potential of very high sensitivity and universal application. In this first example of RIC, separated sample cations are stoichiometrically replaced by a photometrically sensitive cation. Following replacement, the RIC effluent is nebulized into a flame where emission from the photometric species is generated and measured by a filter photometer. The conditions for useful operation of the new RIC instrument are presented and applications are provided of sensitive and efficient sample replacement. The limitations and capabilities of the technique are critically appraised and possible extensions considered. GRA

N83-15380# Indiana Univ., Bloomington. Dept. of Chemistry.
A SEPARATED IMPEDANCE MATCHER/LOAD COIL ASSEMBLY FOR CONVENIENT SPATIAL TRANSLATION OF AN ICP TORCH Interim Technical Report
J. W. Carr, M. W. Blades, and G. M. Hieftje 8 Oct. 1982 16 p refs
(Contract N00014-76-C-0838; Grant NSF CHE-79-18072)
(AD-A120100; INDU/DU/GMH/TR-82-50) Avail: NTIS HC A02/MF A01 CSCL 14/2

The removal of the torch box from the matching network and its subsequent mounting on commercially available translation stages permits precise and accurate positioning of the plasma. This positioning capability, without the required movement of cumbersome pieces of equipment, facilitates fundamental studies and the routine use of the ICP as a source for analytical spectroscopy. GRA

N83-15381# Michigan State Univ., East Lansing.
THE MS/MS TIME-RESOLVED MAGNETIC DISPERSION MASS SPECTROMETRY Interim Technical Report
Christie G. Enke, John T. Stults, John F. Holland, John D. Pinkston, and John Allison 24 Sep. 1982 12 p refs
(Contract N00014-76-C-1092)
(AD-A120172; TR-12) Avail: NTIS HC A02/MF A01 CSCL 07/4

The modification of a magnetic sector mass spectrometer to provide measurement of ion flight time results in a novel instrument which can provide all the data presently obtained from tandem MS/MS instrumentation. The combination of ion momentum and velocity analysis provides unambiguous mass assignments for parent and daughter ions while flight time comparison establishes parent-daughter relationships. Data are obtained from a modified LKB-9000 which demonstrates the feasibility of this technique. Suggestions for an upgraded instrument with automated scanning are made and the possibility of achieving full MS/MS data collection on the chromatographic time scale throuh the use of an integrating transient recorder is presented. GRA

N83-15382# Michigan State Univ., East Lansing.
TIME-RESOLVED MAGNETIC DISPERSION MASS SPECTROMETRY: A TECHNIQUE FOR MULTIDIMENSIONAL ANALYSIS Interim Report
John T. Stults, John F. Holland, and Christie G. Enke 24 Sep. 1982 14 p refs
(Contract N00014-76-C-1092)
(AD-A120133; TR-11) Avail: NTIS HC A02/MF A01 CSCL 07/4

A new type of multidimensional mass spectrometer is presented. Utilization of ion beam pulsing and time-resolved detection techniques in a magnetic sector mass spectrometer allows simultaneous momentum and velocity analysis of the ions. This combination of factors provides parent ion and daughter ion mass assignments that are independent of ion energy. Parent, daughter, and neutral loss spectra can be obtained as in current MS/MS instruments. Equations for mass determination are given, various scanning modes are described, and the expected resolution and sensitivity are evaluated. Demonstration data are presented for daughter ions of a selected metastable decomposition. The potential for the technique in analytical applications is considered, particularly in light of a proposed high-speed data acquisition system; GRA

N83-15383# Indiana Univ., Bloomington. Dept. of Chemistry.
APPROACHING THE LIMIT IN ATOMIC SPECTROCHEMICAL ANALYSIS Interim Technical Report
Gary M. Hieftje 27 Sep. 1982 7 p refs Presented at 183rd Natl. Meeting of the Am. Chem. Soc., Las Vegas, Nev., 29 Mar. 1982
(Contract N00014-76-C-0838; Grants NSF CHE-79-18073; NSF CHE-80-25633; NR Proj. 051-622)
(AD-A120125; INDU/DC/GMH/TR-82-49; TR-57) Avail: NTIS HC A02/MF A01 CSCL 07/4

In atomic spectrochemical methods of analysis, the sample to be analyzed is decomposed into its constituent atoms and the atoms subsequently probed by atomic emission, absorption, or fluorescence. In such methods, it would seem to be straightforward to achieve extremely low detection limits, perhaps approaching the single atom level, since atoms to be probed are in the vapor state, yield extremely narrow spectral lines, and should be relatively unaffected by other sample constituents. However, a number of factors conspire to limit sensitivity and detetectivity in atomic spectrochemical techniques. Among these limitations are the relative inefficiency of most methods currently used for forming the free atoms, the ordinarily brief time available for atom observation which exists after sample decomposition is complete, and the residual background signal which accompanies most atomic spectral measurements. In this paper, a number of recent and proposed techniques to overcome these obstacles will be reviewed and evaluated, with a view toward assessing the present and future practicability of single atom detecton (SAD) methods will be reviewed and new methods will be examined for improving the atomization efficiency of real samples. Techniques for trapping ions or atoms for long term observation will be considered and methods for improving the selectivity of atomic techniques will be assessed; these later techniques are based alternately on spectral, temporal, or chemical characteristics of the elements being sought. Author (GRA)

N83-15384# Tennessee Univ., Knoxville. Dept. of Chemistry.
LOW TEMPERATURE FLUORINATION OF AEROSOL SUSPENSIONS OF HYDROCARBONS UTILIZING ELEMENTAL FLUORINE Interim Technical Report
James L. Adcock, William D. Evans, Lilly Beller-Grossman, and Mark L. Robin Sep. 1982 76 p refs
(Contract N00014-77-C-0685; NR Proj. 053-669)
(AD-A120062; TR-4) Avail: NTIS HC A05/MF A01 CSCL 07/5

The extension of the aerosol fluorination technique to molecules with different hydrogen environments on the molecules has proceeded to include acyl halides, ketones, alkyl halides, amines, and thioethers. Results on the fluorination of molecules with primary, secondary, and tertiary hydrogens is also included, as is the effect of admitting boron trifluoride into the aerosol direct fluorination of neopentane. The aerosol direct fluorination of ketones indicates the carbonyl group remains intact and the major product is the F-ketone, although in some instances acid fluorides result. The use of photochemical excitation of the fluorination reaction is developed further and to date provides the most effective/efficient method for the complete conversion of hydrocarbons to perfluorocarbons. Preliminary optimization of reaction parameters has led to significant yield increases. Aerosol fluorination of larger less volatile molecules is proceeding and virtually no reduction in reactor efficiency has been noted. GRA

N83-15385# Ballistic Research Labs., Aberdeen Proving Ground, Md.

APPLICATION OF CARS TO OBTAIN TEMPERATURE IN PLANE ENVIRONMENTS Final Report
John A. Vanderhoff and Anthony J. Kotlar Aug. 1982 49 p refs (DA Proj. 1L1-61101-A-91A)
(AD-A120047; AD-F300080; ARBRL-TR-02417) Avail: NTIS HC A03/MF A01 CSCL 21/2

A coherent anti-Stokes Raman scattering (CARS) experiment has been assembled and used to determine temperatures in various flame experiments. Using the Q-branch rotational-vibrational cars signal from the N2 molecule, temperature profiles in Ch4/air and Ch4/NeO premixed flames have been obtained. Additionally temperatures have been determined for H2 and CH4 diffusion flames using the CARS signal from the Q-branch of H2. Several possible experiments in ballistics (muzzle flash and propellant strand burning) are discussed in the report. GRA

N83-15386# Puerto Rico Univ., Rio Piedras. Dept. of Physics.
NONPRIMITIVE ELECTROLYTE NEAR A CHARGED WALL: GENERALIZED MEAN SPHERICAL APPROXIMATION Interim Technical Report
F. Vericat, L. Blum, and D. Henderson (IBM Research Lab., San Jose, Calif.) Arlington, Va. Office of Naval Research 1 Sep. 1982 18 p refs Submitted for publication
(Contract N00014-81-C-0776; NR Proj. 051-775)
(AD-A120031; TR-4) Avail: NTIS HC A02/MF A01 CSCL 07/4

In this report we consider a simplified model of an electrode-electrolyte interface which takes into account the discreteness of the solvent. The electrode is represented as a hard infinite plane with a uniform surface charge density, while the electrolytic solution is modeled as a mixture of charged hard spheres (the ions) and dipolar (nonpolarizable) hard spheres (the solvent). In addition, we assume the electrode has a dielectric constant unit; thus we ignore the image effects. For this model we developed a treatment in which all the interactions (ion-ion, ion-solvent, solvent-solvent, electrode solution) are considered on the same (classical) statistical mechanical basis. In particular the solvent is taken as a fully orientable system and no special treatment of a hypothetical inner layer is made. GRA

N83-15387# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
PHASE DIAGRAM OF 3-5 COMPOUNDS BY THE STEP GRADING TECHNIQUE Final Report, 15 Dec. 1978 - 14 Jun. 1982
S. M. Bedair, C. Morrison, and J. R. Hauser Sep. 1982 12 p refs
(Contract DAAG29-81-C-0006; Grant DAAG29-79-G-0028)
(AD-A119879; ARO-16058.6-MS) Avail: NTIS HC A02/MF A01 CSCL 07/2

This research program has produced experimentally the phase diagrams of In-Ga-As, In-Ga-P and In-As-P ternary alloys for the first time over their entire composition range using liquid phase epitaxy techniques.A thermodynamical model based on the simple solution model was developed and more accurate values for several thermodynamical parameters based on extended solidus data for these ternary compounds were obtained. Also a model has been presented to account for the so-called lattice-pulling effect and has been successfully applied to the InGaP/GaAs system. Electrical and structural properties of the epitaxial layers have been studied. The Epitaxial growth of these ternaries both on GaAs and InP substrates assisted in the development of two devices: the cascade solar cell an a photodetector for the 1.8 to 2.0 micrometer range. GRA

N83-15388# California Univ., Irvine. Dept. of Physics.
THE EFFECTS OF SURFACE ROUGHNESS ON THE PROPERTIES OF SOLIDS Final Technical Report, 1 Jul. 1978 - 30 Jun. 1982
A. A. Maradudin Sep. 1982 5 p refs
(Grant DAAG29-78-G-0108)
(AD-A119880; ARO-15902.5-PH) Avail: NTIS HC A02/MF A01 CSCL 07/4

Published results of work that dealt with various effects of surface roughness on the physical properties of solids are discussed. GRA

N83-15389# Pennsylvania State Univ., University Park. Applied Research Lab.
PHOTO FIELD EMISSION AND FIELD EMISSION ENERGY DISTRIBUTIONS FROM SILICON Ph.D. Thesis
Michael H. Herman 13 Jul. 1982 151 p refs
(Contract N00024-79-C-6043)
(AD-A119896; ARL/PSU/TM-82-177) Avail: NTIS HC A08/MF A01 CSCL 07/4

Experimental field emission energy distributions (FEEDs) are reported for both n- and p-type samples of low resistivity. The experimental distributions are characterized by a high intensity single peak, of energy 0.4 eV or more below the Fermi level, with a subsidiary peak of lower intensity, rising from just below the Fermi level. The larger peak drops in energy with increasing field. Experimental FEEDs are compared to those expected theoretically. It is concluded that they are not similar. Comparison with photo-emission work indicates that the large peak is due to a band of surface acceptor states. The subsidiary peak is tentatively ascribed to conduction band electrons. Finally, a phenomenological model of photo-field emission (PFE) is proposed. Based upon both FEED and PFE experiments, this model assumes that emission occurs primarily from surface states. A second component of the current is due to tunnelling of photogenerated electrons. In addition to photoconductivity, a self-regulating break-down mechanism is necessary for qualitative agreement with experimental data. One such mechanism, avalanche, is investigated for the dielectric emitter model. Qualitative agreement is obtained with the characteristics non-linear Fowler-Nordheim behavior observed experimentally. GRA

N83-15390# Air Force Occupational and Environmental Health Lab., Brooks AFB, Tex.
ISOCYANATE MONITORING USING N-p-NITROBENZYL-N-PROPYLAMINE GLASS FIBER SAMPLING TUBE Final Report, Jan. - Apr. 1982
Kathleen A. Carson Aug. 1982 24 p refs
(AD-A119901; OEHL-82-022EH163HAE) Avail: NTIS HC A02/MF A01 CSCL 11/2

N-p-nitrobenzyl-N-propylamine glass fiber sampling tubes were evaluated in the field for detection of Hexamethylene diisocyanate (HDI) during aircraft spray painting and MDI during foam-in-place operations. The tubes, prepared and analyzed according to NIOSH Method P&CAM 326, were satisfactory for HDI monitoring during spray painting, but were inadequate for MDI monitoring under the conditions of the survey. GRA

N83-15391# Oklahoma Univ., Norman. Dept. of Chemistry.
VARIABLE-TEMPERATURE TIN-119m MOSSBAUER STUDY OF TIN(2) AND TIN(4) AMINES
K. C. Molloy, M. P. Bigwood, R. H. Herber (Rutgers Univ.), and J. J. Zuckerman 1 Oct. 1981 13 p refs Submitted for publication
(Contract N00014-77-C-0432; Grants NSF CHE-78-26584; NSF DMR-81-02940; NR Proj. 053-636)
(AD-A119904; TR-38) Avail: NTIS HC A02/MF A01 CSCL 07/4

The dependence of the logarithm of the area under the tin-119m Mossbauer resonance (normalized to the area under the resonance at 77K), 1nA sub T, on temperature in K is measured for two tin (IV) and three tin (II) amines containin the N(CH3)2, N(CH2)2 and the N(si(CH3)3)2 groups. The sloped of the plots of 1nA sub T vs. T are in increasing order of relative steepness, (CH3)3SnN(CH2)2(-0.0116/K for T = 77-140K), Sn(N(N2)2)2, Sn(N(CH3)2)2 (-0.0155/K for T = 77-155K) and Sn(N(Si(CH3)3)2)2 (0.0195/K for T = 77-150K) for the tin (II) compounds. Based on the systematics of the relation between the magnitude of the slops and known structures of tin solids, it is possible to assign bridged polymeric structures to the first four compounds and a structure composed of non-increasing molecular units to the last. GRA

N83-15392# Naval Postgraduate School, Monterey, Calif.
A COMBUSTION AND HEAT TRANSFER MODEL FOR POROUS MEDIA Ph.D. Thesis
Costa S. Vatikiotis Jun. 1982 173 p refs
(AD-A120405) Avail: NTIS HC A08/MF A01 CSCL 21/2

A general combustion and heat transfer model for porous media subject to Darcy flow is formulated. The transient one dimensional model treats the combustion process in two phases. During the initial phase, combustion occurs within the porous medium. The second phase occurs when the exothermic reaction moves to the air inlet surface of the medium resulting in surface recession. The temperature dependency of the system parameters and thermophysical properties is taken into account. An analysis of combustion in a carbon porous medium is presented, as well as an assessment of the accuracy of the model. GRA

N83-15393# Ballistic Research Labs., Aberdeen Proving Ground, Md. Ballistic Research Lab.
NH AND OH CONCENTRATION PROFILES IN A STOICHIOMETRIC CH4/N2O FLAME BY LASER EXCITED FLUORESCENCE AND ABSORPTION TECHNIQUES Final Report
William R. Anderson, Leon J. Decker, and Anthony J. Kotlar Oct. 1982 43 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A120565; AD-F300094; ARBRL-TR-02426) Avail: NTIS HC A03/MF A01 CSCL 21/2

The concentration profiles of NH and OH were measured in an atmospheric pressure premixed laminar CH4/N2O flame over a porous plug flat flame burner. Relative profiles were obtained by laser excited fluorescence for both compounds and normalized by laser absorption at a single point for NH. The OH concentration was high enough to allow absorption measurements at several points for comparison with fluorescence results. The steeply rising portions of the profiles occur at about the same height above the burner but the NH is confined to the primary reaction zone while the OH decay extends into the burnt gases. The apparent OH decay was found, using a simple analysis, to be consistent with second order kinetics as observed by previous workers on other flames. However, it should be noted that diffusion of OH is at least partially responsible for the apparent shape of the profile resulting in the second order decay kinetics found using the simple analysis. The decay rate is smaller than that observed by previous workers for CH4/air flames. Qualitative reasons for the different decay rates found in the studies are discussed in detail. A strong dependence of OH decay rate on final flame temperature, and hence the cooling rate peculiar to the burner concentration in CH4/air, CH4/NO, and H2/N2O flames were made in order to elucidate the flame chemistry. Author (GRA)

N83-15394# Ballistic Research Labs., Aberdeen Proving Ground, Md. Ballistic Research Lab.
FLAT FLAME OLYMPICS: TEST PROBLEM A Final Report
Terence P. Coffee Oct. 1982 46 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A120566; AD-F300100; ARBRL-TR-02431) Avail: NTIS HC A03/MF A01 CSCL 21/2

This report discusses a test problem for a computer program for numerically solving the equations governing a laminar, premixed, one dimensional flame. The problem was proposed by GAMM (Committee for Numerical Methods in Fluid Mechanics), and has been solved for presentation at a workshop at the Technical University, Aachen, Germany, 12-14 Oct. 1981. The test problem is an unsteady propagating flame with one-step chemistry and Lewis number different from unity. A code developed for steady state problems with elementary chemistry was modified to use the simplified transport and chemistry of the test problem and to follow the details of the transient solution. The problem is solved for six cases. The cases differ in the Lewis number chosen and the activation energy of the single reaction. The initial conditions used are the steady state solutions predicted by the simplified analytic method of asymptotic analysis. In most cases, the numerical solutions rapidly converge, and the steady state solutions are similar to the asymptotic solutions. However, in one case, with activation energy and Lewis number equal to two, the solution does not converge. Instead, large oscillations in the flame speed and the profiles occur. GRA

N83-15395# Sandia Labs., Albuquerque, N. Mex.
EFFECTS OF SOLVENT COMPOSITION AND CONCENTRATION ON EARLY LIQUEFACTION REACTIONS
M. G. Thomas 1981 16 p Presented at the H-Coal Tech. Advisory Comm. Meeting, Catlettsburg, Ky., 15 Sep. 1981
(Contract DE-AC04-76DP-00789)
(DE82-004136; SAND-81-2000C; CONF-810999-1) Avail: NTIS HC A02/MF A01

The early reaction chemistry of coal liquefaction includes the dissolution of coal by reaction with solvent to produce preasphaltenes. The subsequent decomposition to asphaltenes and finally to oils can be described with a classic series reaction mechanism. Neither dissolution nor upgrading rates are independent of solvent. In terms of solvent, dissolution appears to be stoichiometric with preasphaltene formation, and secondary reaction rates are dependent upon hydrogen availability. Some of the ramifications of these early reactions are: multistage processing; effective utilization of catalysts; tailored product slate; and hydrogen utilization. DOE

N83-15396# Imperial Coll. of Science and Technology, London (England). Dept. of Chemical Engineering and Chemical Technology.
LOCAL MOBILITY AND TOPOLOGY IN GELS
J. S. Higgins, K. Ma, R. H. Hall, and M. Warner Apr. 1981 20 p refs
(RL-81-013) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Experimental evidence for topologically dependent diffusion in gels and rubbers is presented from high resolution neutron scattering experiments on deuterium labelled model trifunctional networks which show that the junction points move more slowly than the free chain centres by a factor of about two. The diffusional dynamics of particular points of a polymer chain is calculated in the Rouse approximation. The points considered correspond, in the case of incoherent neutron scattering, to the proton-labelled free ends of chains, crosslinks between chains in rubbers or gels, or the central monomers in branched or star polymers. Results derived are also relevant to NMR, ESR and computer simulation experiments. DOE

N83-15397# Brookhaven National Lab., Upton, N. Y.
SOME HIGHLIGHTS IN THE EVALUATIONS OF THE THERMAL CROSS SECTIONS AND RESONANCE PARAMETERS OF THE ACTINIDES
S. F. Mughabghab and M. Divadeenam 1981 26 p refs Presented at the Joint IAEA/NEA Consultants Meeting on Uranium and Plutonium Resonance Parameters, Vienna, 28 Sep. 1981
(Contract DE-AC02-76CH-00016)
(DE82-002218; BNL-NCS-30130; CONF-810957-4) Avail: NTIS HC A03/MF A01

The resonance parameters and thermal cross sections of U235, U238 and Pu239, Pu240, Pu241, and Pu242 are evaluated. Capture, scattering, fission cross sections as well as resonance integrals are calculated from the parameters and are compared with experimental values with the objective of achieving consistency between calculations and measurements. The Dyson-Metha delta sub 3 statistical analysis was applied in order to calculate average level spacings. Calculations of average radiative widths based on systematics are carried out and are compared with experimental values. DOE

N83-15398# Oak Ridge National Lab., Tenn.
SECONDARY-ION MASS SPECTROMETRY: SOME APPLICATIONS IN THE ANALYSIS OF NUCLEAR MATERIAL
W. H. Christie, R. E. Eby, R. J. Warmack, and L. Landau 1981 8 p refs Presented at the 25th Conf. on Anal. Chem. and Nucl. Technol., Gatlinburg, Tenn., 6 Oct. 1981
(Contract W-7405-eng-26)

(DE82-002799; CONF-811025-20) Avail: NTIS HC A02/MF A01

Secondary ion mass spectrometry (SIMS) has been shown to offer some significant advantages over conventional mass spectrometry for the analysis of radioactive samples. We have used SIMS for the rapid, accurate analysis of B, Li, Cs, U and Pu in various nuclear materials. In many instances, SIMS allows one to perform mass and isotopic analysis on samples that are amenable to other mass spectrometric techniques (e.g., surface ionization, electron impact, etc.). The significant advantage that accrues from the use of SIMS for isotopic analysis of these materials is the complete elmination of any chemical sample preparation steps, and only sample dissolution is necessary for the application of isotope dilution methods for quantitative analysis. The high sensitivity of SIMS for B, Li, U and Pu makes it possible to analyze sufficiently small radioactive samples so that radiation is reduced to acceptable levels for safe handling. The precision of SIMS isotopic analysis for natural B samples is about 0.5% and is about 1% for natural Li samples. DOE

N83-15399# Sandia Labs., Albuquerque, N. Mex.
VAPOR PRESSURE OF LIQUID URANIUM OXIDE: A REVIEW
W. Breitung 1981 15 p refs Presented at the NBS Joint Conf.: 8th Symp. on Thermophys. Properties; 17th Thermal Conductivity Conf.; and the 8th Thermal Expansion Conf., Gaithersburg, Md., 15 Jun. 1981 Sponsored in part by Kernforschungszentrum
(Contract DE-AC04-76DP-00789)
(DE82-001097; SAND-81-1383C; CONF-8106164-1) Avail: NTIS HC A02/MF A01

Vapor pressures of liquid oxide reactor fuels are among the most important material data required for theoretical analyses of Hypothetical Core Disruptive Accidents (HCDAs) in Fast Breeder Reactors. This is an attempt to completely summarize and critically review the numerous theoretical and experimental results published for the pressure-temperature and pressure-energy relation of UO2, First, to define the research goal, the precision in the saturation vapor pressure which is required for HCDA purposes, is quantified. Then the various theoretical and experimental methods used for the determination of p-T and p-U data are reviewed with respect to their results and uncertainties. The achievements of the individual methods are discussed in the light of the research goal and, in view of the widely scattered data, p-T as well as p-U relations are recommended for liquid UO2. DOE

N83-15400# Brookhaven National Lab., Upton, N. Y.
APPLICATIONS OF WITHIN-EVENT PRECIPITATION CHEMISTRY MEASUREMENTS
G. S. Raynor and J. V. Hayes 1981 19 p refs Presented at ASTM Symp. and Workshop on Sampling and Analysis of Rain, Philadelphia, 7 Oct. 1981
(Contract DE-AC02-76CH-00016)
(DE82-002226; BNL-30146; CONF-811089-1) Avail: NTIS HC A02/MF A01

Chemical measurements from hourly sequential precipitation samples and simultaneous meteorological measurements and observations were analyzed to discover relationships between chemical species, to infer atmospheric mechanisms, to relate precipitation chemistry to meteorological events and conditions, and to identify probable pollutant source regions. Analytical methods that can be applied to short period samples but usually not to event, weekly or monthly samples are described and illustrated. Changes in concentrations of chemical species during precipitation events can be documented and used to infer atmospheric processes. These changes can also be related to meteorological conditions such as changes in rainfall rate and wind direction or to frontal passages. Source directions and probable source regions can be located by wind direction and trajectory analyses. Means of many samples taken under similar conditions can document relationships between meteorological conditions, concentrations in precipitation and amounts of wet deposition. DOE

N83-15401# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
STUDY OF THE FORMATION OF SUBMICRON PARTICULATES GENERATED BY COAL COMBUSTION Quarterly Progress Report, 1 Jul. - 1 Oct. 1981
P. M. Sherman and D. R. Glass Nov. 1981 20 p refs
(Contract DE-FG22-80PC-30305)
(DE82-003268; DOE/PC-30305/T4; QPR-4) Avail: NTIS HC A02/MF A01

The mineral matter in coal fouls boiler surfaces and produces particulates which can be detrimental to vegetation and hazardous when inhaled. The particulates emitted have been controlled to some extent by costly add-on equipment. Such equipment is more effective in removing the larger particles than the smaller particles. The smaller ones are the ones however, which can be the most hazardous. They tend to be enriched in many of the most toxic elements and are the ones that tend to stay in the lungs and may adhere to boiler surfaces. If formation of these particles can be prevented, costly clean up could be eliminated. Our purpose is to investigate the mechanisms which result in submicron particles so that we may prescribe ways to prevent their formation. This quarter has been devoted to examining some of the gross trends in the particulate emissions as a function of heat transfer and combustion parameters. DOE

N83-15402# Avco-Everett Research Lab., Mass.
VOLATILE PRODUCTION DURING PREIGNITION HEATING Quarterly Progress Report, Jul. - Sep. 1981
Oct. 1981 21 p refs
(Contract DE-AC22-80PC-30291)
(DE82-003061; DOE/PC-30291-4) Avail: NTIS HC A02/MF A01

The relationship between volatile matter production from pulverized coal and flame stabilization in a boiler environment was examined. The entire flow, optics and diagnostic systems were installed in the test cell and are operational. Problems with beam quality for the CO2 laser were remedied by the design of a new beam splitting roof prism mirror. Coal is flowed in the presence of laser heating and the flow behaves qualitatively as expected. DOE

N83-15403# California Univ., Davis.
NUCLEAR METHODS IN CHEMICAL KINETICS Technical Progress Report, 1 Apr. - 30 Sep. 1981
1981 17 p refs
(Contract DE-AT03-76ER-70158)
(DE82-004305; DOE/ER-70158/T2) Avail: NTIS HC A02/MF A01

Progress in nuclear methods in chemical kinetics is reported. The following projects are presented: (1) the recoil 18F vs. C2F6 reaction system; (2) the recoil 18F vs CF3Cl and 39Cl vs CF3Cl reaction systems; (3) recoil 18F vs CF4/RH and C2F6/RH reactive mixture experiments; (4) photochemical 14C unimolecular kinetics; and (5) the 11th International Hot Atom Chemistry Symposium. DOE

N83-15404# Atominstitut der Oesterreichischen Hochschulen, Vienna.
NON-DESTRUCTIVE INVESTIGATIONS OF BURNUP FROM SPENT TRIGA-FUEL ELEMENTS BY GAMMA SPECTROSCOPY Ph.D. Thesis [GAMMASPEKTROSKOPISCHE ABBRANDUNTERSUCHUNGEN AN BESTRAHLTEN TRIGA BRENNELEMENTEN]
Helga Kitzmueller Dec. 1980 122 p refs In GERMAN; ENGLISH summary
(INIS-mf-6416) Avail: NTIS (US Sales Only) HC A06/MF A01; DOE Depository Libraries

The gamma activity of selected fission products was measured to determine burnup. The Cs-137 gamma line was used at 8 different positions per fuel rod. The fuel rod was sited on the thermal column in the reactor pool at a depth of 4m during the measurement. The fuel rod container was connected with the collimator tube and a drive tube, both reaching to the water surface. With this arrangement 19 fuel rods were measured. One was also measured at 3 azimutale positions. The data was evaluated on a computer system. DOE

N83-15405# Instituto Nacional de Investigaciones Nucleares, Mexico City (Mexico). Inst. de Fisica.
A GENERALIZED RESONATING GROUP METHOD WITH ABSORPTIVE INTERACTION
E. Hernandez and A. Mondragon 1981 23 p refs Presented at the 4th Oaxtepec Symp. on Nucl. Phys., Oaxtepec, Mex., 5-7 Jan. 1981 Submitted for publication
(DE81-700767; ININ-81-3; CONF-810127-3) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

A generalized Hill-Wheeler equation for the elastic collision at two composite nuclei is obtained projecting the complete many-body Schroedinger equation on the subspace of model internal wave functions and on its orthogonal complement. A non hermitian (absorptive) interaction term W results which takes into account the flux loss in the elastic channel, besides the usual RGM effective Hamiltonian and normalization kernels. A perturbation series expansion or W containing only linked diagrams is given. Finally, the antisymmetrized product of internal wave functions of the fragments that appear in the projection operator is expressed in terms of complex generator coordinates, then the terms appearing in effective interaction can be written as matrix elements of the microscopic interactions and/or the antisymmetrizer between two center shell model states. DOE

N83-15406# Atomic Energy Research Establishment, Harwell (England). Chemistry Div.
THE FORMATION, IDENTIFICATION AND ELIMINATION OF VARIOUS IONIC SPECIES OF IODINE OCCURRING IN THE PRODUCTION OF IODINE-123
R. Clegg (Brunel Univ.), A. Roberts (Brunel Univ.), H. E. Sims, and J. A. Winter 1982 22 p refs
(AERE-R-10154) Copyright. Avail: Issuing Activity

Iodine 123 has long been recognized as being an isotope with almost ideal properties for nuclear diagnosis. This isotope is prepared on a weekly basis for dispatch to hospitals. One of the problems in the quality control of this isotope is the formation of unknown ionic species. These species are analyzed, identified, and eliminated. The use of labelled o-iodo hippuric acid (hippuran) with Iodine 123 for renal studies and the effect of various ionic species of iodine on its labelling efficiency are discussed. The effect of the addition of various artifacts is also discussed. S.L.

N83-15407# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.
AN AUTOMATED ELECTROCHEMICAL TEST FACILITY
C. Westcott, G. P. Marsh, and D. E. Williams Feb. 1982 15 p
(AERE-R-10361) Avail: NTIS HC A02/MF A01

The design and operation of an automated electrochemical test facility is described. By careful choice of components the construction of special interfaces was avoided and a flexible and inexpensive system, easy to install and operate, was obtained. Applications of the system are indicated and examples discussed. Author

N83-15408# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.
THE PERMEATION OF GASES THROUGH SOLIDS. 1: PRINCIPLES
A. D. LeClaire Nov. 1981 61 p refs
(AERE-R-9911) Avail: NTIS HC A04/MF A01

The principles underlying the permeation of gases through solids are reviewed and discussed. General equations are developed to describe the permeation rates J in their dependence on pressure, p, diffusion coefficient, D, and solubility (Sievert) constant K, on the rates at the surfaces of dissociation, adsorption and solution and of the corresponding reverse processes, and on the degree of dissociation in the gas phase. At normal pressures and temperatures J alpha p (1/2) and is governed by the product DL = P, the high pressure permeability. But as p decreases, the surface processes increasingly influence and ultimately wholly determine J. J is then proportional to p and always less than estimated from P. The change from J alpha p (1/2) to J alpha p occurs over a pressure range that is very sensitive to the physico-chemical condition of the surfaces; it may be as high as around a torr or so in some cases (e.g., H in stainless steel), very considerably less in others. In consequence, low pressure permeation rates may be difficult to quantify reliably. Author

N83-15885# Los Alamos Scientific Lab., N. Mex. Chemistry-Materials Science Div.
CHEMICAL PHYSICS OF VAPORIZATION, CONDENSATION AND GAS-SURFACE ENERGY EXCHANGE Final Report
Gerd M. Rosenblatt *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 32 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10A

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N83-15409 International Iron and Steel Inst., Brussels (Belgium). Committee on Raw Materials.
CHROMIUM AND THE STEEL INDUSTRY
V. Zoli, A. Sweeney, F. G. Pitcher, M. Yoshida, P. J. C. Pretorius, and R. Delin Mar. 1981 126 p
(IISI/RAMCO-CR-81) Copyright. Avail: Issuing Activity

Chromium reserves and resources are estimated. Chromium is discussed in relation to its production, trade, and applications. The use of chromium in steels is emphasized. S.L.

N83-15410*# IIT Research Inst., Chicago, Ill.
CREEP-RUPTURE BEHAVIOR OF IRON SUPERALLOYS IN HIGH PRESSURE HYDROGEN Quarterly Narrative Report, 1 Oct. - 31 Dec. 1980
S. Bhattacharyya 20 Jan. 1981 81 p Sponsored by NASA. Lewis Research Center
(NASA-CR-169716; NAS 1.26:169716; KIITRI-M6061-15; QR-5) Avail: NTIS HC A05/MF A01 CSCL 11F

Two cast alloys (CRM-6D and XF-818) and four sheet alloys (A-26, Incoloy 800H, N-155, and 19-9DL) in the thickness range of 0.79 to 0.99 mm were evaluated for use in the Stirling engine. The creep rupture behavior of these iron base high temperature alloys is being determined in air for 10 hr to 3,00 hr, and in 20.7 MPa (3,000 psi) H2 for 10 to 300 hr at temperatures of 650 deg to 925 deg. Material procurement, preparation and air creep rupture testing are described and existing data is analyzed. Systems for the high pressure hydrogen testing are discussed. Statistical analysis of temperature-compensated rupture data for each alloy is included. A.R.H.

N83-15411*# Pittsburgh Univ., Dept. of Metallurgical and Materials Engineering.
MECHANISM OF HOT CORROSION OF IN-738 Final Report
G. H. Meier 9 Dec. 1982 20 p refs
(Grant NsG-3214)
(NASA-CR-169706; NAS 1.26:169706) Avail: NTIS HC A02/MF A01 CSCL 11F

The Na2SO4 - induced hot corrosion of IN-738 in the temperature range 900 C to 1000 C is characterized by an initiation stage during which the corrosion rate is slow followed by a propagation stage during which the corrosion rate is markedly accelerated. In the second stage, corrosion is accelerated due essentially to a sulfidation/oxidation mechanism; in the third stage, the rate becomes catastrophic due to acid fluxing induced by an accumulation of refractory metal oxides (particularly MoO3) in the Na2SO4. The sequential stages in the corrosion process are described and a mechanism proposed. The influence of alloy microstructure on the corrosion mechanism is also discussed. A.R.H.

N83-15412*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
POWDER METALLURGY RENE 95 ROTATING TURBINE EN-

GINE PARTS, VOLUME 2 Final Report
L. G. Wilbers and T. K. Redden Jan. 1981 30 p refs
(Contract NAS3-20074)
(NASA-CR-165142; NAS 1.26:165141; R80AEG664-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 11F

A Rene 95 alloy as-HIP high pressure turbine aft shaft in the CF6-50 engine and a HIP plus forged Rene 95 compressor disk in the CFM56 engine were tested. The CF6-50 engine test was conducted for 1000 C cycles and the CFM56 test for 2000 C cycles. Post test evaluation and analysis of the CF6-50 shaft and the CFM56 compressor disk included visual, fluorescent penetrant, and dimensional inspections. No defects or otherwise discrepant conditions were found. These parts were judged to have performed satisfactorily. S.L.

N83-15413*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
UNIVERSAL APPROACH TO ANALYSIS OF CAVITATION AND LIQUID-IMPINGEMENT EROSION DATA
P. Veerabhadra Rao and Stanley G. Young Nov. 1982 39 p refs
(NASA-TP-2061; E-1087; NAS 1.60:2061) Avail: NTIS HC A03/MF A01 CSCL 20D

Cavitation erosion experimental data was analyzed by using normalization and curve-fitting techniques. Data were taken from experiments on several materials tested in both a rotating disk device and a magnetostriction apparatus. Cumulative average volume loss rate and time data were normalized relative to the peak erosion rate and the time to peak erosion rate, respectively. From this process a universal approach was derived that can include data on specific materials from different test devices for liquid impingement and cavitation erosion studies. S.L.

N83-15414# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
TECHNIQUES FOR INVESTIGATING STRUCTURE AND COMPOSITION WITH HIGH SPATIAL RESOLUTION Technical Report, Oct. 1980 - Sep. 1981
John B. VanderSande 1 Dec. 1981 9 p refs
(Contract N00014-81-K-0013)
(AD-A119919; TR-4) Avail: NTIS HC A02/MF A01 CSCL 11/6

The techniques of scanning transmission electron microscopy and field ion microscopy/atom probe are briefly described. The advantages of these techniques for high spatial resolution compositional analysis are discussed and examples are cited. GRA

N83-15415# California Univ., Los Angeles. Dept. of Materials Science and Engineering.
EFFECTS OF HEAT-TREATMENT OF PRE-YIELD BURST EMISSIONS OF A533B STEEL
Hong-Bee Teoh, Itzhak Roman, and Kanji Ono Sep. 1982 11 p refs
(Contract N00014-81-K-0011)
(AD-A120067; TR-82-01) Avail: NTIS HC A02/MF A01 CSCL 11/6

Nonmetallic inclusions strongly affect the ductility and acoustic emission (AE) characteristics of A533B steel. Our present and previous studies have revealed highly anisotropic AE behavior during tensile and fracture testing, originating from the particular morphological features of MnS inclusions. In the present study, the effect of different heat treatment practices on the role of MnS matrix interfaces in generating AE has been investigated. Although both L and S orientations of ASTM A533B steel were examined, pre-yield burst type emissions were observed only in the S-orientation. The pre-yield, burst type AE activities increased drastically with tempering temperature (up to 750 C) for samples that were furnace-cooled after tempering. A maximum in this AE activity was noted for specimens that were oil-quenched subsequent to tempering, around a tempering temperature of 600 C. This AE behavior is explained by the occurrence of two phenomena. First, some of the MnS-matrix interfaces debcnd due to thermal stresses set up during quenching. Second, during tempering, partial cohesion of debonded interfaces commences along with the segregation of sulfur to the interfaces. Upon tensile loading, these interfaces fracture at relatively low stresses and generate the observed, burst-type AE in the pre-yield region of the S-orientation tensile samples. GRA

N83-15416# California Univ., Los Angeles. Dept. of Materials Science and Engineering.
ACOUSTIC EMISSION BEHAVIOR OF NICKEL DURING TENSILE DEFORMATION
S.-Y. S. Hsu and K. Ono Sep. 1982 10 p refs
(Contract N00014-81-K-0011)
(AD-A120065; TR-82-02) Avail: NTIS HC A02/MF A01 CSCL 11/6

Commercial 99.6% purity nickel (Ni-200) was studied in detail for its AE behavior. The specimens slowly cooled from high-annealing temperature exhibited much higher AE levels than the quenched samples. This was attributed to the existence of solute pinning atmospheres around dislocations. The kinetic study using AE technique quantitatively determined the activation energy of solute diffusion, which was found to be close to the activation energy for the carbon diffusion in nickel. An AE source model based on the dislocation acceleration and/or deceleration following unpinning was presented. Theeffects of deformation temperature, including dynamic strain aging phenomenon, were also discussed. GRA

N83-15417# Mississippi Univ., University. Dept. of Physics and Astronomy.
ENERGY AND MOMENTUM ACCOMMODATION COEFFICIENTS ON PLATINUM AND SILVER
F. Douglas Shields 20 Oct. 1982 16 p refs
(Contract N00014-81-K-0691; NR Proj. 384-836)
(AD-A120742) Avail: NTIS HC A02/MF A01 CSCL 11/6

Acoustical measurements of energy and tangential momentum accommodation coefficients indicate stable and reproducible Pt and Ag surfaces are obtained by heating in a vacuum. EAC and TMAC values are given for He and Ne on the heat-cleaned Pt and Ag surfaces and for these gases on Pt and Ag surfaces after exposure to various adsorbent gases. AC values are also given for the various adsorbent gases on themselves on the heat-cleaned Pt and Ag surfaces. Author (GRA)

N83-15418# Florida Univ., Gainesville. Dept. of Materials Science and Engineering.
GRAIN REFINING AND MICROSTRUCTURAL MODIFICATION DURING SOLIDIFICATION Annual Report, 1 Sep. 1981 - 31 Aug. 1982
G. J. Abbaschian Oct. 1982 51 p refs
(Contract N00014-81-K-0730)
(AD-A120770) Avail: NTIS HC A04/MF A01 CSCL 11/6

The objective of the program is to study grain refining and microstructural modification during solidification, as affected by supercooling, the solidification rate, and/or inoculation. The experimental technique consists of using an electromagnetic levitation technique to melt one gram samples, followed by rapid solidification of the superheated or supercooled sample in a quenchant. The research activities so far have been concentrated in thefollowing areas: (1) grain refining via peritectic reaction in Cu-Fe alloys, (2) microstructure aand solute distribution in highly-supercooled Fe-Ni alloys, and (3) supercooling and microstructure of Cr, Ni and Cr-Ni alloys. For Cu-Fe alloys, it has been observed that the addition of iron progressively reduces the grain size of the copper in alloys 2.8 w/o Fe, the minimu concentration necessary for the peritectic reaction. In the hyperperitectic alloys, where iron is the primary phase, increasing the iron concentration does not seem to influence the grain size appreciably. However, the cooling rate through the solid-liquid range above the peritectic temperature and coarsening of primary iron particles seem to have a major effect on the grain size. GRA

N83-15419# Honeywell Corporate Technology Center, Bloomington, Minn.

NEW X-LEVEL DETECTORS Final Report, 1 Jun. 1980 - 31 May 1981
David Arch Wright-Patterson AFB, Ohio AFWAL Jan. 1982 51 p refs
(Contract F33615-80-C-5026)
(AD-A120788; AFWAL-TR-81-4151) Avail: NTIS HC A04/MF A01 CSCL 11/6

The objectives of this program were to determine the feasibility of using the In-X center in silicon as the active level in a photoconductive device for the 8-14 micron atmospheric window and to clarify the role, if any, which aluminum plays in the formation of the In-X defect. Most evidence points to the In-X center being an indium-carbon complex which shows a mass-action type behavior but there is some speculation that In and Al constitute the defect and that carbon stabilizes this association. To utilize the In-X level in an efficient photoconductive device requires concentration of the In-X defect in the 5-10 x 10 to the 16th power cm-3 range. To achieve these concentrations, near maximum concentrations of indium and carbon in silicon are required. The gradient transport solution growth method of crystal growth was adopted to dope the silicon with near maximum amounts of In and C. Material from Si(In,C) growth runs were then subjected to a variety of low temperature heat treatments (<600C) to study the reaction kinetics of the In-X center. This was done to determine if suitable concentrations of In-X could be obtained in reasonable annealing times. It was found that, contrary to the mass action law, the concentrations of In-X centers decreased with increased annealing times. GRA

N83-15420# Phrasor Scientific, Inc., Duarte, Calif.
DEVELOPMENT OF A TABLETOP MODEL FOR THE GENERATION OF AMORPHOUS/MICROCRYSTALLINE METAL POWDERS Final Technical Report, 1 May 1978 - 31 May 1982
John F. Mahoney, Julius Perel, Zef Shanfield, Bernard E Kalensher, and Scott Taylor Jul. 1982 129 p refs
(Contract N00014-77-C-0373; ARPA Order 3363)
(AD-A120584; Rept-82) Avail: NTIS HC A07/MF A01 CSCL 11/6

Electrohydrodynamics (EHD) was used as a basis for the generation and control of charged liquid droplets in order to produce micro-size powders and splat coatings. The EHD technique requires the use of intense electric fields to generate liquid droplets directly from the liquid state. This is achieved by delivering a molten alloy to the tip of a fine capillary nozzle to which high voltage is applied. Resistance heater technology was developed, resulting in greater reliability and temperatures of 1800K were achieved. Powders smaller than 0.01 micron have been produced with calculated cooling rates of approximately 10 to the 7th power K/s from radiation cooling alone. Several aluminum alloys were sprayed and produced small single spherical crystals, cicrystals, and adherent coatings. Amorphous powders and coatings (due to splat cooling) were formed using a Fe-Ni-B-P metallic glass alloy. Thin films were produced by EHD deposition of Si and Ge semiconductor materials. An Engineering Model was developed to study operation of an EHD powder generator using automation and modern computer techniques. Results of these studies were used to design, construct, and deliver a Micro-Particle Processor for use as a research instrument for experimentation with fine powders, and the production of coatings and thin films, involving rapid solidification. Author (GRA)

N83-15421# Los Alamos Scientific Lab., N. Mex.
VACUUM DEPOSITION OF HIGH-QUALITY METAL FILMS ON POROUS SUBSTRATES
Barry L. Barthell and David V. Duchane 1981 18 p refs Presented at the 28th Natl. Am. Vacuum Soc. Symp., Anaheim, Calif., 7 Nov. 1981
(DE82-000573; LA-UR-81-2820; CONF-811113-16) Avail: NTIS HC A02/MF A01

A composite mandrel was developed consisting of a core of low density polymethylpentene foam overcoated with a thin layer of film forming polymer. The surface tension and viscosity of the coating solution are important parameters in obtaining a polymer film which forms a continuous, smooth skin over the core without penetrating into the foam matrix. Water soluble film formers with surface tensions in the range of 45 dynes/cm and minimum viscosities of a few hundred centipoises were found most satisfactory for coating polymethylpentene foam. By means of this technique continuous polymer films with thicknesses of 10 to 20 microns were formed on the surface of machined polymethylpentene foam blanks. Aluminum was vacuum deposited onto these composite mandrels to produce metal films which appear smooth and generally defect free even at 10,000 times magnification. R.J.F.

N83-15422# Atomic Energy of Canada Ltd., Chalk River (Ontario). Nuclear Lab.
TRITIUM IN AUSTENITIC STAINLESS STEEL VESSELS. THE INTEGRITY OF THE VESSEL
C. E. Ells Dec. 1980 16 p refs
(AECL-6972) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Austenitic stainless steels recommended for components of hydrogen-handling equipment in applications where high in-service reliability is required are discussed. The literature leading to the recommendation of austenitic steels is reviewed, and it is shown that AISI Type 316L stainless is particularly suitable for use in tritium-handling and storage systems. When made of this steel, the storage vessels will be extremely resistant to any gradation from tritium in both routine and accident conditions. DOE

N83-15423# Sandia Corp., Albuquerque, N. Mex.
CORROSION REACTIONS IN LITHIUM-SULFUR DIOXIDE CELLS
S. C. Levy 1981 14 p refs Presented at Electrochem. Soc. Conf., Denver, 11 Oct. 1981
(Contract DE-AC04-76DP-00789)
(DE82-003579; SAND-81-0917C; CONF-811013-11) Avail: NTIS HC A02/MF A01

Long term testing of Li/SO2 cells resulted in many premature failures. Studies of failed cells indicated corrosion contributed significantly to the failure mechanisms. In particular, two corrosion reactions were conspicuous, in the glass at the glass to metal seal and at the tantalum in the positive lead. A program was initiated to solve these problems. Models for the corrosive attacks were developed. Based on the models, a new glass formulation was prepared and a new positive lead material selected. Initial tests showed the new materials to have a significant improvement in corrosion resistance over the standard materials. DOE

N83-15424# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
COMPARISON OF THE MECHANICAL STRENGTH PROPERTIES OF SEVERAL HIGH-CHROMIUM FERRITIC STEELS
M. K. Booker, V. K. Sikka, and B. L. P. Booker 1981 29 p Presented at the Intern. Conf. on Production, Fabric., Properties, and Appl. of Ferritic Steels for High-Temp. Appl., Warren, Pa., 6 Oct. 1981
(Contract W-7405-eng-26)
(DE82-001454; CONF-811069-1) Avail: NTIS HC A03/MF A01

A modified 9 Cr-1 Mo ferritic steel was selected as an alternative material for breeder reactors. Different 9 Cr-1 Mo steels are already being used commercially in UK and USA and a 9 Cr-2 Mo steel (EM12) is being used commercially in France. The 12% Cr steel alloy HT9 is also often recommended for high-temperature service. Creep-rupture data for all six steels were analyzed to yield rupture life as a function of stress, temperature, and lot-to-lot variations. Yield and tensile strength data for the three 9 Cr-1 Mo materials were also examined. All results were compared with Type 304 stainless steel, and the tensile and creep properties of the modified and British 9 Cr-1 Mo materials were used to calculated allowable stress values. DOE

N83-15425# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
CORROSION OF MELTER MATERIALS

W. N. Rankin 1981 9 p refs Presented at the Electrochem. Soc. Conf., Denver, 11 Oct. 1981
(Contract DE-AC09-76SR-00001)
(DE82-001800; DP-MS-81-22; CONF-811013-5) Avail: NTIS HC A02/MF A01

The effects of five variables on the corrosion rate of electrode and refractory materials: temperature, atmosphere inside the melter, composition of the glass, velocity, and electrochemical potential were characterized. As a data base for comparison, the corrosion rate was determined for Monofrax K - 3 (1.2 mils/day) and Inconel 690 (0.7 mils/day) in waste glass of the simulated reference SRP composition at 1150 C in air. These tests were carried out as specified in ASTM C-621-68 with a slight modification. After the specimens were heated they were sectioned. The specimens were measured at the melt line cut and at the half down cut (halfway between the melt line cut and the bottom of the specimen). DOE

N83-15426# Sandia Labs., Albuquerque, N. Mex.
SURFACE COMPOSITION OF A TIN-LEAD ALLOY
G. C. Nelson and J. A. Borders 1981 34 p refs Presented at the Am. Vacuum Soc. Natl. Symp., Anaheim, Calif., 3 Nov. 1981
(Contract DE-AC04-76DP-00789)
(DE82-003345; SAND-81-2495C; CONF-811113-35) Avail: NTIS HC A03/MF A01

The surface and near surface composition of a single phase tin-lead alloy whose bulk composition was 99.83 at. % tin and 0.17 at. % lead was measured as a function of temperature in vacuum and in an oxidizing ambient. In vacuum, the outer monolayer of the surface is enriched in lead at all temperatures studied (= 65% at. % Pb at 23 C). From the measured lead surface composition as a function of temperature, a heat of segregation of 4.7 kcal/mole is calculated. The data obtained in an oxidizing ambient indicate that the near surface composition is dependent on the oxygen partial pressure as well as the temperature at which the sample is annealed. DOE

N83-15427# Oak Ridge National Lab., Tenn.
CORROSION IN FRACTIONATION SYSTEMS
R. A. Bradley, J. R. Keiser, R. R. Judkins, V. B. Baylor, and J. H. DeVan 1981 12 p refs Presented at the 6th Ann. Conf. on Mater. for Coal Conversion and Util., Gaithersburg, Md., 13 Oct. 1981
(Contract W-7405-eng-26)
(DE82-001441; CONF-811061-3) Avail: NTIS HC A02/MF A01

All data collected to date suggest that chlorine, as water soluble chlorides, is necessary, albeit not sufficient, to cause the accelerated corrosion observed in pilot plant fractionation columns. Mechanisms for the transportation of chlorine to the fractionation columns, for the concentration of chlorine in these columns, and for the corrosion of the materials of construction of these columns are proposed. The source of the chlorine is the coal feed. When the coal is fed to the dissolver vessels, hydrogen chloride may be formed by volatilization or by hydrolysis of chloride salts followed by volatilization. These amine hydrochlorides are transported in liquid streams to the fractionation area. Washing the coal liquids with water to remove the water soluble chlorides and the addition of certain amines are proposed as methods for reducing the corrosion. DOE

N83-15428# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
ADVANCED CASTING TECHNOLOGY
London Aug. 1982 332 p refs In ENGLISH and FRENCH Meeting held in Brussels, 4-9 Apr. 1982
(AGARD-CP-325; ISBN-92-835-0314-6) Avail: NTIS HC A15/MF A01

The current state of developments of advanced casting technology was examined. The use of aluminum alloy castings for main structural application, which is likely to increase significantly, is emphasized. The following topics are discussed: use and developments of casting; developments in casting theory and practice; developments in casting practice; and developments in casting practice and quality control. For individual titles, see N83-15429 through N83-15447.

N83-15429# British Aerospace Aircraft Group, Kingston-upon-Thames (England).
ADVANCED CASTINGS IN THE DESIGN OF MILITARY AIRCRAFT
D. J. Duckworth and R. M. Shaw *In* AGARD Advan. Casting Technol. Aug. 1982 10 p refs (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

The use of castings and the developments which took place from the user point of view, over a period of years, were reviewed. It is suggested that in any new design the final shape used is always a compromise. Factors as cost, structural efficiency, mechanical properties and quality must be considered. Interaction of these factors and the more important areas where development is required are shown. More extensive use of castings in modern airframes in the future is anticipated. E.A.K.

N83-15430# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany). Materials and Processes Development Dept.
ADVANCED CASTING: TODAY AND TOMORROW
Dietmar Mietrach *In* Agard Advan. Casting Technol. Aug. 1982 18 p refs Document also announced as N82-28486 (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

The state of foundries and limitations of foundry practice and experience of these foundries are summarized. Components were redesigned in cooperation with the foundries to make them more castable. The aim of the Economic Structures Technology-Metals program (WST-M) is to demonstrate the practicability of new technologies and to put the economy in the foreground. Cost benefit analyses of different representative military components, castings of primary structure parts by chosen foundries and the mechanical values of static/dynamic tests are reported. A prognosis for use of castings in aviation industry, for the further development of casting techniques and materials in future is given. E.A.K.

N83-15431# Technische Hogeschool, Delft (Netherlands). Dept. of Materials Science.
SOME DEVELOPMENTS IN CASTING TECHNOLOGY
H. Nieswaag *In* AGARD Advan. Casting Technol. Aug. 1982 19 p refs (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

Information on the main developments in casting technology and metal processing in the last decades, that improved the quality of modern castings is presented. The metallurgical aspects of the casting process, developments in alloys, ferrous as well as nonferrous, control and understanding of the as cast structure are emphasized. The relation between microstructure and properties for some aluminum alloys is discussed. Improvements in the sand casting practice, that resulted in castings of a more complex shape and higher dimensional accuracy is reviewed. E.A.K.

N83-15432# Aical Ltd., Altrincham (England).
DEVELOPMENT IN ALUMINUM ALLOY INVESTMENT CASTINGS
P. H. Jackson *In* AGARD Advan. Casting Technol. Aug. 1982 12 p (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

The main objectives in the development of aluminum alloy investment castings as seen by the Investment Foundry Industry are outlined. Some examples of the successful utilization of parts produced by the process for aerospace and high integrity applications are reviewed. The advantages to be derived from close collaboration between design engineers and the foundary are illustrated. Developments in investments casting technology and the possibilities or the extended use of investment cast parts in aerospace and defense equipment to which these could lead in the near future are cited. E.A.K.

N83-15433# Magnesium Elektron Ltd., Swinton (England).
DEVELOPMENT AND TRENDS IN MAGNESIUM ALLOY TECHNOLOGY
W. Unsworth and J. F. King *In* AGARD Advan. Casting Technol. Aug. 1982 15 p refs (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

Developments in Magnesium alloys, casting technology and corrosion protection are examined. Alloys with improved ambient and elevated temperature capability to meet specific user requirements are described. It is indicated that significant improvements in temperaure stability are possible giving alloys with strength at least comparable with current used aluminum alloys on an equal volume basis. Adoptation of resin bonded sands and the simultaneous development of techniques for producing longer and thinner cored passageways has enabled foundries to meet the aerospace industries requirements for more complex and larger castings. Current protective techniques are reviewed and possible developments to improve cost effectiveness of protection are discussed. E.A.K.

N83-15434# Drexel Univ., Philadelphia, Pa. Dept. of Materials Engineering.
STRUCTURAL CONTROL IN SOLIDIFICATION PROCESSING
D. Apelian *In* AGARD Advan. Casting Technol. Aug. 1982 14 p refs (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

Control of heat flow, fluid flow and mass flow during solidification which allows structural control of the cast product is discussed. The importance of the mushy zone width and local solidification time while in the mushy zone are discussed. Three processes rheocasting, diffusion solidification and the VADER melting process are discussed for solidification fundamentals, process advantages and applications. E.A.K.

N83-15435# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Zwijnaarde (Belgium). Foundry Research Centre.
NUMERICAL SIMULATION OF CASTING SOLIDIFICATION APPLICATION TO THE SAND-COATED GRAVITY DIE CASTING PROCESS
G. Vanhoutte *In* AGARD Advan. Casting Technol. Aug. 1982 15 p refs (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

Numerical simulation of casting solidification was carried out to develop design rules for the production of sound S.G. iron castings through directional solidification in sand coated gravity dies. The parameters that govern heat transfer during solidification and subsequent cooling were assessed. Heat transfer during the freezing of an alloy in a sand coated metallic mould is fairly complex and cannot be described analytically. Using the finite differnce method for approximating the partial differential equations, a mathematical model was first set up for one dimensional heat transfer phenomena in cartesian coordinates. E.A.K.

N83-15436# GKN Group Technological Centre, Wolverhampton (England). Process Technology Dept.
THE SQUEEZE FORMING OF ALUMINIUM ALLOYS
Gwynne Williams *In* AGARD Advan. Casting Technol. Aug. 1982 15 p refs (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

The squeeze forming process is a hybrid manufacturing technology which involves the pressurized solidification of liquid metal in reusable dies. The basic process is described and the importance of various process parameters is discussed. A range of aluminum alloy components which use this technique is shown. Mechanical property data determined in several of these components are presented for a number of aluminum alloys. It is observed that both forging and casting alloys can be successfully squeeze formed, and the mechanical properties achieved compare favorable with conventional properties. The work performed shows that squeeze forming is a potentially powerful technique for the manufacture of a wide range of structural aluminum components in competition with more conventional production methods. E.A.K.

N83-15437# Messier Fonderie, Arudy (France).
RECENT DEVELOPMENTS IN SAND CASTING UNDER LOW PRESSURE ADAPTED FOR MAKING LARGE CASTINGS OF AERONAUTICAL STRUCTURES [DERNIERS DEVELOPPMENTS DE LA COULEE EN SABLE SOUS BASSE PRESSION ADAPTES A LA REALISATION DE GRANDES PIECES DE STRUCTURES AERONAUTIQUES]
Georges Broihanne *In* AGARD Advan. Casting Technol. Aug. 1982 7 p refs In FRENCH (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

Sand casting under low pressure for large areas which allows the structural assembly of forgings of one piece blocks conceived previously by the assembly of metal sheets or machined structures is discussed. The casting offers superior possibilities over classical casting by gravity: filling of fine cloth on large surfaces; metallurgic benefits even for complex structures; perfect reproduction casting of conditions; and the possibility to cast complex areas of high strength alloys. Transl. by E.A.K.

N83-15438# Titan-Aluminum-Feinguss G.m.b.H., Bestwig (West Germany).
NEW DEVELOPMENTS IN ALUMINUM AND TITANIUM INVESTMENT CASTINGS
Guenther Wedeking *In* AGARD Advan. Casting Technol. Aug. 1982 8 p (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

Aluminum and Titanium are most important basic materials in modern aircraft construction. The contribution of aluminum investment castings for manufacturing of aircraft units is discussed. Integral construction is one of the features of modern aircraft construction. This involves limiting the expensive assembly of individual parts to a minimum. Investment casting has proved to be an especially efficient moulding process as it combines considerable cost savings in material, assembly and machining with the unsurpassed degree of freedom it gives to the designer of the individual casting. The investment casting process has to compete with other moulding processes for the technological aspects of a component. Tolerances, achievable dimensions and wall thicknesses of a component and, the strength of the material are essential. E.A.K.

N83-15439# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Helicopter and Transport Div.
AN EVALUATION OF VACUUM CENTRIFUGED TITANIUM CASTINGS FOR HELICOPTER COMPONENTS
L. J. Maidment and H. Paweletz *In* AGARD Advan. Casting Technol. Aug. 1982 7 p refs Document also announced as A81-41516 (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

The applicability of centrifugally cast Titanium (Ti6Al4V) for a critical helicopter component, a rotor head, was investigated. The economic aspects were considered. The results of the investigation are summarized as follows: the endurance limit of cast Titanium is approximately 63% that of the wrought alloy, a 15% reduction in the machining costs was achieved. Improvements in the centrifugal casting technique leading to enhanced microstructural and mechanical material properties play a decisive role in extending the application of cast Titanium in the Aerospace industry. E.A.K.

N83-15440# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy and Materials Science.
GRAIN REFINEMENT OF CAST NICKEL-BASE SUPERALLOYS AND ITS EFFECT ON PROPERTIES
A. F. Denzine, T. A. Kolakowski, and J. F. Wallace *In* AGARD Advan. Casting Technol. Aug. 1982 26 p refs (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

The influence of refinement of the cast grains on the mechanical properties of nickel base superalloys was studied. The T63 is

produced from MAR-M-246 by a vacuum investment casting process. The conventional casting techniques employed in its manufacture result in large columnar grains which cause an anisotropic fatigue behavior. The grain refining technique developed consisted of adding 0.12B to the melt and establishing the proper time temperature cycles so that substrates for effective heterogeneous nucleation were available for grain refinement of the different section sizes in the T-63 rotor. The mechanical properties include tensile properties, low cycle fatigue resistance, combined fatigue, creep lives, thermal fatigue and oxidation properties, and stress rupture behavior were determined for the unrefined, fine columnar, and refined equiaxed structures of the three test alloys.E.A.K.

N83-15441# Detroit Diesel Allison, Indianapolis, Ind.
CAST TITANIUM COMPONENTS FOR ROTATING GAS TURBINE APPLICATIONS
Bruce A. Ewing *In* AGARD Advan. Casting Technol. Aug. 1982 14 p (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

Investment cast titanium compressor impellers and integrally bladed rotor components which offer the potential for significant cost reduction in gas turbine design were examined. Cast titanium development activities are discussed, and examples of rotating components with accompanying dimensional and mechanical property data are presented. Future trends and needs in this technology area are also discussed. E.A.K.

N83-15442# Turbomeca S. A. - Brevets Szydlowski, Bordes (France).
MAKING CRITICAL COMPONENTS BY PRECISION CASTING [REALISATION DE PIECES CRITIQUES EN FONDERIE DE PRECISION]
M. Brun, G. Vandendriessche, D. Fournier, and M. Meurtin *In* AGARD Advan. Casting Technol. Aug. 1982 39 p refs In FRENCH (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

The construction of critical components for turbomachinery by precision casting is discussed. The construction of components for turbomachinery in cast has increase. This development applied to all kinds of materials like steel, superalloys, titanium, aluminum and other kinds of products. The invention is an extension of this technology in its application to rotating bodies like turbine wheels and compressor wheels. E.A.K.

N83-15443# British Columbia Univ., Vancouver.
ELECTROSLAG CASTING EVALUATION
A. Mitchell and G. Sidla *In* AGARD Advan. Casting Technol. Aug. 1982 10 p (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

The development of a cheap, simple version of the electroslag casting process (ESC) process intended for the manufacture of castings in the weight range from 10 - 1000 Kg is reported. The application of ESC to the production of a number of cast shapes, such as gears and shafts and tubular sections is demonstrated. Mechanical property investigations for these components and comments on the range of ESC application are discussed. The electroslag remelting process is an accepted method of producing high quality forgings in a variety of steels and related alloys. At a very early stage in the process's development it was recognized that the technique had the potential to cast not only ingots but also simple shapes. From this recognition stems the electroslag casting (ESC) process, and the product's use in the as cast condition. E.A.K.

N83-15444# Cosworth Research and Development Ltd., Worcester (England).
A NEWLY DEVELOPED PROCESS (THE GKN AND COSWORTH PROCESS) FOR THE PRODUCTION OF HIGH INTEGRITY ALUMINUM ALLOY CASTINGS
J. Campbell and P. S. A. Wilkins (GKN Contractors Ltd., Redditch, England) *In* AGARD Advan. Casting Technol. Aug. 1982 6 p refs (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

The production of high integrity aluminum alloys castings is a process of high precision, low pressure sand casting technique. The process is characterized by an improvement in accuracy over conventional sand castings by a factor of 4 or 5 in external features, and by a factor of approximately 20 times in internally cored features. Very high integrity and good surface finish are routinely obtained in production. The successful application of the process to certain military vehicle and aerospace products is described. E.A.K.

N83-15445# Titan-Aluminum-Feinguss G.m.b.H., Bestwig (West Germany).
QUALITY ASSURANCE IN TITANIUM AND ALUMINUM INVESTMENT CASTINGS
Christian Liesner *In* AGARD Advan. Casting Technol. Aug. 1982 3 p (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

Quality assurance and its importance in the permanently rising requirements of higher quality of investment casting products as well as new laws with intensifed manufacturing liability of producer is discussed. The presence of an efficient quality assurance system is the basic requirement for approval as supplier for the aircraft and aerospace industry. The integration of the quality assurance department into the company organization as well as its responsibility, jurisdiction and competence are defined in a quality assurance manual. An essential precondition for an efficient quality assurance system is a smooth flow of information between the production areas and quality control department concerned. The main task is to prevent faults occurring. The cost of high quality has to be minimized and its purpose or effectiveness to be maximized. E.A.K.

N83-15446# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Evry Cedex (France).
THE QUALITY AND CONTROL OF PRECISION CASTINGS FOR TURBOMACHINES [QUALITE ET CONTROLE DES PIECES DE FONDERIE DE PRECISION POUR TURBOMACHINES]
J. Thiery and J. Voeltzel *In* AGARD Advan. Casting Technol. Aug. 1982 11 p In FRENCH (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

The high temperature characteristics of nickel and cobalt base alloys require a perfect matrix for castng so that the potential qualities of the metals are preserved. The principal aircraft turbine components made by precision casting are discussed as well as the problems encountered in their fabrication. The quality of these castings must be considered during these stages: (1) selection of the base material; (2) selection of waxes and shells, mold design, and casting; (3) dissecting, adjusting, and conducting nondestructive tests of the components; and (4) overseeing the manufacture to determine the total range of quality and ascertain the deviations. Future techniques are needed to lessen the sensibility to microporosity by modifying the alloys or by isostatic pressing. Some method is needed to maintain control of quality when making hollow vanes. A.R.H.

N83-15447# Cercast 1979, Inc., Montreal (Quebec).
METALLURGICAL ASPECTS OF QUALITY CONTROL IN THE PRODUCTION OF PREMIUM QUALITY ALUMINUM INVESTMENT CASTINGS FOR THE AEROSPACE INDUSTRY
Steve Kennerknecht *In* AGARD Advan. Casting Technol. Aug. 1982 51 p refs (For primary document see N83-15428 06-26)
Avail: NTIS HC A15/MF A01

Development and innovations in the metallurgical state of the are in investment casting is discussed. Metallurgical variables which influence the production of premium quality investment castings were examined. An extensive comprehension of grain refinement, modification, chilling, alloy composition, heat treatment, destructive testing and basic metallurgy, are essential tools when confronted with a difficult casting problem. E.A.K.

N83-15448# United Kingdom Atomic Energy Authority, Harwell (England). Materials Development Div.

PERMEATION OF GASES THROUGH SOLIDS. 2: AN ASSESSMENT OF MEASUREMENTS OF THE STEADY STATE PERMEABILITY OF H AND ITS ISOTOPES THROUGH Fe, Fe BASED ALLOYS AND SOME COMMERCIAL STEELS

A. D. LeClaire Jul. 1982 35 p refs
(AERE-R-10598) Copyright. Avail: Issuing Activity

The permeation constant for H2 in pure alpha Fe recommended by Gonzalez in 1969 was well confirmed by 12 or more measurements made since then. Austenitic stainless steels show a permeability to H2 that seems relatively insensitive to composition. Approximately 30 of the 40 or more results on steels with 15% to 26% Cr, 6% to 28% Ni show the permeation constant (P sub M) to be within a factor 1.5 either way of the value given by P sub m = 2.33 x 0.01 exp (-15,700 cals mol/RT) css(STP) H2/cm/s/atm/2. The permeation constant for ferritic alloys and steels is nearly always greater than for the austenitic, but always below that for pure alpha Fe. Data are discussed for ferritic alloys with Si, Mo, Ni, C, and Cr. Author

N83-15449# United Kingdom Atomic Energy Authority, Harwell (England). Nuclear Physics Div.

MOESSBAUER STUDY OF NICKEL CONTAINING 0.5 PERCENT IRON BETWEEN ROOM TEMPERATURE AND THE CURIE POINT

G. Longworth and T. E. Cranshaw Jul. 1982 8 p
(AERE-R-10621) Copyright. Avail: Issuing Activity

The Mossbauer measurements of the temperature variation of the spectra for nickel containing 0.5% iron was obtained. No evidence was found for the magnetic first order phase transition. S.L.

N83-15450# United Kingdom Atomic Energy Authority, Harwell (England). Dept. of Metallurgy and Materials Science.

THE PHYSICAL METALLURGY OF REVERSIBLE TEMPER EMBRITTLEMENT

B. L. Eyre, B. C. Edwards (United Kingdom Atomic Energy Authority, Harwell), and J. M. Titchmarsh (United Kingdom Atomic Energy Authority, Harwell) Jul. 1982 56 p refs Presented at Advan. in the Phys. Met. and Appl. of Steels, Liverpool, 21-24 Sep. 1981
(AERE-R-10343) Avail: Issuing Activity

The role of metallurgical factors influencing the susceptibility of low to medium alloy ferritic steels to reversible temper embrittlement (RTE) is reviewed. Particular emphasis is placed on considering the role played by microstructure in terms of its effect on both the degree of grain boundary segregation and mechanical properties. Considerable advances have been made in recent years in electron microscopy techniques in characterizing microstructure in terms of type, composition and distribution of second phase precipitates down to 5nm diameter. Thus, it is now possible to follow the often complex carbide transformations that occur in alloy steels as a function of thermal history in much more detail. Results from using these techniques to study temper embrittlement, particularly in Ni-Cr steels are reviewed. It was shown that carbide transformations and the precipitation of other phases can influence strongly grain boundary segregation and thus the susceptibility to temper embrittlement. Carbide precipitation processes also influence bulk strength levels, which again have an effect on the susceptibility to temper embrittlement. It is concluded that in order to fully understand the factors influencing the RTE behavior of steel, it is essential to characterize fully the microstructural changes as well as grain boundary segregation and mechanical properties. Author

N83-15451# Atomic Energy Research Establishment, Harwell (England). Materials Physics Div.

ULTRASONIC ATTENUATION, MICROSTRUCTURE AND DUCTILE TO BRITTLE TRANSITION TEMPERATURE IN Fe-C ALLOYS

R. L. Smith, K. L. Rusbridge, W. N. Reynolds, and B. Hudson Aug. 1982 15 p refs
(AERE-R-10633) Copyright. Avail: Issuing Activity

The effect of varying the carbon content on the microstructure, ultrasonic attenuation and ductile to brittle transition temperature in a set of high purity Fe-C alloys of approximately constant grain size was investigated. Both the ultrasonic attenuation and DBTT were sensitive to the amount of carbon present, the change in fracture properties being due to the formation of a brittle cementite phase and the attenuation was probably caused by changes in the amount of dislocation damping. The relevance of these and previous results to the nondestructive evaluation of materials properties is discussed. Author

N83-15452# Council for Scientific and Industrial Research, Pretoria (South Africa).

PROCEEDINGS OF THE 3RD SEMINAR ON EFFICIENT METAL FORMING AND MACHINING

3 Nov. 1981 280 p refs Seminar held at Pretoria, 3 Nov. 1981
Avail: NTIS HC A13/MF A01

The machining process determines the geometric as well as the physical state of technical surfaces. The properties of the surface are often of dominant influence on the functional behavior of a component. This is true especially for the important physical surface properties such as plastic deformation, texture, microhardness, and residual stresses are described. Mechanisms of surface impact are discussed and a systematic approach to distinguish them is shown. S.L.

N83-15453# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.

THE INFLUENCE OF MATERIAL VARIABLES ON CORROSION FATIGUE CRACK GROWTH IN REACTOR PRESSURE VESSEL STEELS IN PWR PRIMARY WATER Interim Report

P. M. Scott and A. E. Truswell Mar. 1982 34 p refs
(AERE-R-10421) Avail: NTIS HC A03/MF A01

Experimental results for corrosion fatigue crack growth in several different ferritic pressure vessel steels including A533-B and A508-III exposed to simulated pressurized water reactor primary water at 288 C are described. Since relatively little influence of environment was detected in low frequency tests on these materials, in contrast with data reported from another laboratory, specimens were exchanged and tested in each laboratory. These results are described and possible reasons for the observed differences when each tested the same material are discussed. The environmental influence on corrosion fatigue crack growth is analysed on the basis of a model of a sequence of protective oxide rupture/repassivation events during fatigue cycling. The repassivation kinetics and the controlling electrochemical factors are judged to be of crucial significance in determining the extent of environmental enhancement of fatigue crack growth. Author

N83-15454# Atomic Energy Research Establishment, Harwell (England). Metallurgy Div.

MICROMECHANISMS OF DUCTILE, STABLE CRACK GROWTH IN NUCLEAR PRESSURE VESSEL STEELS

W. P. A. Belcher and S. G. Druce Sep. 1981 34 p refs
Avail: NTIS HC A03/MF A01

The relationship between the micromechanisms of ductile crack growth, the microstructural constituent phases present in nuclear pressure vessel steel and the observed fracture behavior as determined by impact and fracture mechanics tests is discussed. Results from a microstructural and mechanical property comparison of an A508 Class 3, PWR nozzle forging cutout and a 150 mm thick A533B Class 1 plate are reported. The variation of upper shelf toughness between the two steels and its orientation sensitivity are discussed on the basis of inclusion and precipitate distributions. Inclusion clusters in A533B, deformed to elongated discs in the rolling plane, have a profound effect on short transverse fracture properties. Data derived using the multispecimen J-integral method to characterise the initiation of ductile crack extension and resistance to stable crack growth are compared with equivalent Charpy results. Results of the J sub R curve analyses indicate that the A533B short transverse crack growth resistance is approximately half that observed from transverse and longitudinal specimen orientations, and that the A508 initiation toughness and resistance to stable crack growth are insensitive to position through

the forging wall, and are higher than exhibited by A533B at any orientation in the mid-thickness position. R.J.F.

N83-15455# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.
THE EFFECT OF A SOL-DERIVED CERIUM OXIDE COAT ON THE OXIDATION OF NICKEL
A. T. Chadwick Jan. 1982 36 p refs
(AERE-R-10352) Avail: NTIS HC A03/MF A01

A cerium oxide (CeO2) coal of mean thickness 0.1 micrometer or less, deposited from a sol on to high purity nickel having a thin nickel oxide film, reduces the parabolic rate constant for oxidation between 600 C and 800 C by an order of magnitude. The CeO2 coat breaks up and is incorporated in the growing oxide, where it reduces the mean grain size. Grain boundary diffusion of nickel is known to be the dominant transport mechanism at these temperatures and transport along grain boundaries should be favored by a finer grain size. Hence the presence of cerium must reduce the grain boundary diffusion coefficient by a larger factor than it slows oxidation. The mechanism of this effect is so far unclear. At 900 C the CeO2 coating becomes less effective and at 1000 C, where transport by lattice diffusion becomes important, it is no longer protective. New growth of nickel oxide occurs mainly outside the cerium rich region, indicating outward transport of nickel. At 1100 C the CeO2 coat increases the oxidation rate, probably by CeO2 in solid solution within the nickel oxide scale enhancing lattice diffusion of nickel vacancies. Author

N83-15456# National Bureau of Standards, Washington, D.C. Metallurgy Div.
INDENTATION LOADING STUDIES OF ACOUSTIC EMISSION FROM TEMPER AND HYDROGEN EMBRITTLED A533B STEEL
R. B. Clough and H. N. G. Wadley (Atomic Energy Research Establishment, Harwell, England) Dec. 1981 36 p refs
(AERE-R-10400) Avail: NTIS HC A03/MF A01

Isothermal tempering at 500 C (within the region rendering low alloy steels susceptible to reversible temper embrittlement) induced acoustic emission activity in A533B steel during indentation loading. Samples, when sectioned, were found to contain small (approximately 10 microns long) MnS inclusions some of which had debonded from the matrix material when they were near the indentations. Hydrogen charging prior to testing greatly enhanced the acoustic emission activity. It also resulted in the formation of small (approximately 20 to 200 microns) microcracks in samples tempered at 500 C. These microcracks, when examined by optical metallography, appear to have propagated along prior austenite grain boundaries, consistent with fractographic observations of temper embrittlement in other low alloy steels. Many were nucleated by MnS inclusion debonding and all were constrained to within a few hundred micrometers of the sample surface and within 2 or 3 indenter diameters from the indent. It is proposed that trace impurities (P, As, Sb, Sn) diffuse during the 500 C temper to both the MnS inclusion interface and the prior austenite grain boundaries, reducing local cohesive strength. S.L.

N83-15457# Atomic Energy Research Establishment, Harwell (England). Metallurgy Div.
SURFACE SEGREGATION IN TYPE 316 STAINLESS STEEL. PART 1: EXPERIMENTAL PROCEDURE AND GENERAL TRENDS IN SEGREGATION
M. Wall, C. M. Shepherd, B. C. Edwards, and J. M. Titchmarsh Jan. 1982 37 p refs
(AERE-R-10355-Pt-1; FRDC/MWP/P(81)1387-Pt-1; FRDC/MWP/MPSG/P(81)341-Pt-1) Avail: NTIS HC A03/MF A01

The construction and operation of a specimen heating stage is described which enables the analysis of the surface of a flat specimen by Auger Electron Spectroscopy while the specimen is maintained at a temperature of up to 1000 C. This stage was used to examine the free surface segregation behavior of minor alloying and trace impurity elements in a commercial cast of type 316 stainless steel in the temperature range 500 to 700 C. As the time or temperature is increased the dominant segregated elements change in the order N, Si, P and S. Interpretation of the results is complicated by factors such as evaporation, chemical interactions, site competition and precipitation. While these effects prevent quantitative estimates of grain boundary segregation levels to be made from surface segregation measurements in a complex alloy, the free surface segregation is considered to reflect, qualitatively, the grain boundary segregation and internal cavity segregation behavior, within the bulk of the material. Author

N83-15458# Atomic Energy Research Establishment, Harwell (England). Metallurgy Div.
A COMPARISON OF THE MICROSTRUCTURE OF A508 CLASS 3 AND SA533B CLASS 1 STEELS FOLLOWING SIMULATED POST WELD HEAT TREATMENT
J. M. Titchmarsh and A. F. Bartlett Nov. 1981 30 p refs
(AERE-R-10333) Avail: NTIS HC A03/MF A01

The microstructure of a 150 mm thick plate of SA533B Class I ferritic steel was examined following a simulated post weld heat treatment (PWHT) and compared with the microstructure of the as received, quenched and tempered material. The most noticeable differences were the increased number of acicular Mo2C precipitates present and some alignment of dislocations into cell structures following PWHT. A comparison was also made as a function of through thickness position with the microstructure of a 545 mm thick forging of A508 steel in the quenched, tempered and PWHT condiction. Significant differences were found in the nature and distribution of the tempered austenite transformation products due to the different cooling rates during quenching. The segregation patterns also differed in the two sections, with the greatest segregation occurring at the center of the plate and at the inner wall of the forging. The plate contained significantly more inclusions than the forging. Author

N83-15459# Atomic Energy Research Establishment, Harwell (England). Chemistry Div.
THE CHARACTERISATION OF PRECIPITATED MAGNETITES
D. F. Rush and D. L. Segal Jun. 1982 29 p refs
(AERE-R-10521) Avail: NTIS HC A03/MF A01

Methods are described for the preparation of magnetite by precipitation from aqueous solutions of iron(II) and iron(III) salts. The magnetites were characterized by transmission electron microscopy, chemical analysis and X-ray diffraction. Transmission Mossbauer spectroscopy was used to characterize precipitated magnetites and a comparison of the spectra was made with those obtained from nickel ferrite and hydrated ferric oxides. The hydrothermal stability of magnetite at 573 K was investigated. R.J.F.

N83-15460# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.
AMMONIUM BETA ALUMINA
B. C. Tofield, J. M. Newsam, and A. Hooper Nov. 1981 3 p refs Presented at the Intern. Conf. on Fast Ion Transport in Solids, Gatlinburg, Tenn., May 1981
(AERE-R-10213) Avail: NTIS HC A02/MF A01

The structural and compositional behavior of ammonium beta alumina, both at room temperature, and as a function of temperature during heating until ultimate transformation to alpha- alumina is obtained near 1050 C is discussed. The room-temperature structure is simpler, but the thermal decomposition more complex than previously assumed. R.J.F.

N83-15461# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.
SILVER-AMMONIUM BETA ALUMINA
B. C. Tofield Nov. 1981 4 p refs Presented at the Intern. Conf. on Fast Ion Transport in Solids, Gatlinburg, Tenn., May 1981
(AERE-R-10214) Avail: NTIS HC A02/MF A01

The exchange of ammonium by silver ions in beta alumina is described and the thermal evolution of silver-ammonium beta alumina is outlined. Treatment of silver beta alumina in molten ammonium nitrate yields two separate beta-alumina phases within

the same crystal rather than a mixed single-phase material as is generally assumed to occur in beta alumina ion exchanges. The extent of exchange at 210 C is indicated by an opaque exchange front and the c-axis lattice constants on either side are close but not identical to those of the ammonium and silver compounds. On heating, the two compositions interdiffuse and, ultimately, stoichiometric silver beta alumina is formed within the crystal. As well as providing a single-stage preparation of a stoichiometric metal beta alumina, such a mixed crystal should provide a fascinating vehicle for the study of the interaction of related but insoluble phases produced by controlled solid state reaction. The conclusions drawn from the silver-to-ammonium exchange are confirmed by study of the exchange of partially-decomposed ammonium beta alumina in molten silver nitrate. Author

N83-15462# Atomic Energy Research Establishment, Harwell (England). Nuclear Physics Div.
A DEMONSTRATION OF ON-LINE PLANT CORROSION MONITORING USING THIN LAYER ACTIVATION
J. Asher, J. W. Webb, N. J. M. Wilkins, and P. F. Lawrence Dec. 1981 16 p refs
(AERE-R-10391) Avail: NTIS HC A02/MF A01

The corrosion of a 1' water pipe in an evaporative cooling system was monitored over three periods of plant operation using thin layer activation. The corrosion rate was followed at a sensitivity of about 1 micron, and clearly reflected changes in plant operation. Examination of the test section after removal, both by autoradiography and metallography revealed the extent of corrosion and pitting over the active area. R.J.F.

N83-15463# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.
CHEMISTRY EFFECTS IN CORROSION FATIGUE
P. M. Scott Mar. 1982 39 p refs
(AERE-R-10481) Avail: NTIS HC A03/MF A01

The objective is to identify those common threads running through the experimental observations that enable one to deduce which are the important chemical and electrochemical interactions with the environment influencing the fatigue strength, or cyclic endurance, or fatigue crack propagation kinetics of a given material or class of materials. Interpretation of the effects of chemical and electrochemical variables is seen to be dependent both on the basic knowledge of surface corrosion and crevice corrosion phenomena and the perception of the relative importance of the crack initiation and propagation phases of corrosion fatigue failure in particular materials and test specimen geometries. R.J.F.

N83-15464# Atomic Energy Research Establishment, Harwell (England). Metallurgy Div.
FATIGUE CRACK INITIATION MECHANISMS IN POLYCRYSTALLINE IRON
R. Dulniak, F. Gulu, and B. C. Edwards Jan. 1982 27 p refs
(AERE-R-10156) Avail: NTIS HC A03/MF A01

The results of an investigation of fatigue crack initiation in polycrystalline iron as a function of testing frequency (0.01-1000Hz) are given. Three distinct types of fatigue crack initiation mechanisms were identified. At low frequencies, < 0.5Hz, cracks were observed to nucleate at intrusions, extrusions and grain boundaries. However over the frequency range studied the cracks at the intrusions and extrusions were not associated with the final fatigue failure. The results suggest that in pure iron frequencies <0.01Hz are required for fatigue failure to be initiated at intrusions and extrusions. At frequencies <0.01Hz at high strain amplitudes, cracks nucleated at the intersection of grain boundaries with the free surface as a result of the incompatable deformation of surface grains. The subsequent propagation of these cracks resulted in fatigue failure. Tests performed at low strain amplitude at 5Hz and 1000Hz initiated surface grain boundary cracking without any significant associated change of grain shape. The results indicate that fagitue failure is initiated at grain boundaries. R.J.F.

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N83-15465* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POLYVINYL ALCOHOL CROSS-LINKED WITH 2 ALDEHYDES Patent
Dean W. Sheibley, Lorra L. Rieker, Li-Chen Hsu, and Michelle A. Manzo, inventors (to NASA) Issued 10 Jun. 1981 6 p Filed 10 Jun. 1981 Supersedes N81-27279 (19 - 18, p 2459)
(NASA-Case-LEW-13524-1; US-Patent-4,357,402; US-Patent-Appl-SN-272234; US-Patent-Class-429-206; US-Patent-Class-264-104; US-Patent-Class-429-253; US-Patent-Class-525-61) Avail: US Patent and Trademark Office CSCL 07C

A film-forming polyvinyl alcohol resin is admixed, in aqueous solution, with a dialdehyde crosslinking agent which is capable of crosslinking the polyvinyl alcohol resin and a water soluble acid aldehyde containing a reactive aldehyde group capable of reacting with hydroxyl groups in the polyvinyl alcohol resin and an ionizable acid hydrogen atom. The dialdehyde is present in an amount sufficient to react with from 1% to 20% by weight of the theoretical amount required to react with all of the hydroxyl groups of the polyvinyl alcohol. The amount of acid aldehyde is from 1% to 50% by weight, same basis, and is sufficient to reduce the pH of the aqueous admixture to 5 or less. The admixture is then formed into a desired physical shape, such as by casting a sheet or film, and the shaped material is then heated to simultaneously dry and crosslinking the article.

Official Gazette of the U.S. Patent and Trademark Office

N83-15466*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INFRARED EMISSION SPECTROPHOTOMETRIC STUDY OF THE CHANGES PRODUCED BY TIN COATING OF METAL SURFACES IN AN OPERATING EHD CONTACT
Leonhard E. Keller, James L. Lauer, and William R. Jones, Jr. 1982 19 p refs Presented at the Joint Lubrication Conf., Washington, D.C., 5-7 Oct. 1982; sponsored by the Am. Soc. of Lubrication Engr. and ASME Sponsored by Army Research Office Prepared in cooperation with Rensselaer Polytechnic Inst.
(Grants NsG-3170; AF-AFOSR-3473-78)
(NASA-TM-82989; E-1398; NAS 1.15:82989) Avail: NTIS HC A02/MF A01 CSCL 20K

Infrared emission spectra and related measurements were obtained from an operating ball/plate elastohydrodynamic (EHD) sliding contact under a variety of operating conditions. In order to be able to compare the effect of the ball surface, some of the balls were coated with a thin layer of titanium nitride (TiN) by vapor deposition. Polyphenyl ether (5P4E) was used as lubricant and 1 percent of 1,1,2-trichloroethane (TCE) as a surface-probing additive. TiN is chemically inert and its thermal conductivity is lower than that of steel. Therefore, the overall temperatures with TiN coated balls were higher. Nevertheless, no scuffing was observed with the coated balls under conditions giving rise to scuffing with the uncoated balls. Tractions were lower with the TiN coated balls and always when TCE was added to the 5P4E. These findings were found to be inversely related to the degree of polarization of the spectral emission bands. The intensity and the dichrosim of these bands were related to shear rates and inlet conditions of the EHD contact. S.L.

N83-15467*# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
ADVANCED CERAMIC COATING DEVELOPMENT FOR INDUSTRIAL/UTILITY GAS TURBINE APPLICATIONS Final Report
C. A. Andersson, S. K. Lau, R. J. Bratton, S. Y. Lee, K. L. Rieke, J. Allen, and K. E. Munson Feb. 1982 154 p refs
(Contracts DEN3-110; DE-AI01-77ET-13111)
(NASA-CR-165619; NAS 1.26:165619) Avail: NTIS

HC A08/MF A01 CSCL 11B

The effects of ceramic coatings on the lifetimes of metal turbine components and on the performance of a utility turbine, as well as of the turbine operational cycle on the ceramic coatings were determined. When operating the turbine under conditions of constant cooling flow, the first row blades run 55K cooler, and as a result, have 10 times the creep rupture life, 10 times the low cycle fatigue life and twice the corrosion life with only slight decreases in both specific power and efficiency. When operating the turbine at constant metal temperature and reduced cooling flow, both specific power and efficiency increases, with no change in component lifetime. The most severe thermal transient of the turbine causes the coating bond stresses to approach 60% of the bond strengths. Ceramic coating failures was studied. Analytic models based on fracture mechanics theories, combined with measured properties quantitatively assessed both single and multiple thermal cycle failures which allowed the prediction of coating lifetime. Qualitative models for corrosion failures are also presented. E.A.K.

N83-15468*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A COMMENTARY ON SOLID LUBRICANTS AND WEAR RESISTANT SOLIDS FOR USE IN EXTREME ENVIRONMENTS

Harold E. Sliney 1982 17 p refs Presented at the Joint Lubrication Conf., Washington, D.C., 4-6 Oct. 1982; sponsored by ASME and Am. Soc. of Lubrication Engr.

(NASA-TM-83042; E-1486; NAS 1.15:83042) Avail: NTIS HC A02/MF A01 CSCL 11H

The need for high temperature tribological coatings and self-lubricating materials in advanced technology is discussed. A qualitative model for the mechanism of solid lubrication is proposed. The model is based upon microscopic observations of the dynamics of third-body solids in lubricated contacts. In this model, the rheology of plastic flow is suggested as a more general criterion for predicting the lubricating potential of a solid material than, for example, a specific crystal structure. Some examples of layer-lattice and nonlayer-lattice solids that lubricate by virtue of their extreme plasticity, film coherence, and adhesion to the lubricated metal are described. Circumstantial evidence for the model is presented for low shear-strength solids at room temperature and for solids such as calcium fluoride that become lubricative only when their brittle-to-ductile transition temperature is exceeded. Some materials considerations in the selection of hard-coat materials for wear control are also presented. M.G.

N83-15469# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.

MODEL NETWORK POLYMERS Final Report

Christopher W. Macosko Sep. 1982 10 p

(Contract DAAG29-79-C-0091; Grant DAAG29-76-G-0110)

(AD-A119969; ARO-13214.7-CH; ARO-16389.7-CH) Avail: NTIS HC A02/MF A01 CSCL 11/9

Under this grant we applied and extended a recursive theory which describes structural features of crosslinking polymers. We developed experimental techniques for synthesizing and characterizing model networks of polydimethylsiloxane. We successfully applied the recursive theory to predict basic structural parameters like: molecular weight, gel point and sol fraction at various stages during network formation. A recursive relaton for the weight average molecular weight of the longest linear chain through the molecule was developed and found to correlate viscosity rise during network polymerization. Sol fraction results were used with the theory to predict crosslink density, junction functionality and trapped entanglement fraction. These parameters were used to test classical and more recent theories of rubber elasticity against stress strain response of the silicone networks. The contribution of chain-chain interactions, often called entanglements, was found to be significant. Twenty publications are listed in the report. GRA

N83-15470# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemistry.

HIGHLY CONDUCTING, IODINE-DOPED FLUOROALUMINUM AND FLUOROGALLIUM NAPHTHALOCYANINE POLYMERS Interim Technical Report

Lee A. Schechtman and Malcolm E. Kenney 20 Oct. 1982 33 p refs

(Contract N00014-75-C-0693)

(AD-A120837; CWRU/DC-TR-11) Avail: NTIS HC A03/MF A01 CSCL 11/9

Methods for the preparation and some of the properties of the new compounds fluoroaluminum and fluorogallium 2,3-naphthalocyanine are described. It is clear on the basis of the data gathered that these fluorides are composed of chains having metal-fluorine backbones and cofacial rings. A procedure for the preparation of iodinated species from these fluorides and some of the properties possessed by these species are described. Of particular interest are the relatively high conductivities they show when they have moderate iodine contents. It is concluded that they contain cationic chains having metal-fluorine backbones and cofacial rings, triiodide and pentaiodide ions, and, possibly, uniodinated chains. Additional conclusions related to the ability of these species to conduct are discussed. Factors which in general may or do influence the conductivity of cofacial conducting polymers are also discussed. Author (GRA)

N83-15471# Pennwalt Corp., King of Prussia, Pa. Central Research and Development Dept.

SOLID LUBRICANTS FOR IMPROVED WEAR RESISTANCE Final Report, 1 Apr. 1979 - 30 Sep. 1981

James P. King and Yayesh Asmerom Jul. 1982 52 p refs

(Contract N00014-79-C-0305)

(AD-A120092) Avail: NTIS HC A04/MF A01 CSCL 11/6

Detailed studies including synthesis, characterization and evaluation of antimony thioantimonate, SbSbS4, were carried out. As a solid lubricant additive in various greases, this material exhibited superior extreme pressure and antiwear properties as demonstrated by the Four-Ball weld points and load-wear indexes on both AISI-52100 and AISI-440C steels. Moreover, impressive abrasive wear resistance properties were imparted by low concentrations of SbSbS4 in greases deliberately contaminated with hard abrasive particles. This additive appeared to be compatible with all the base greases investigated including a silicone grease in which very few additives show good response. The lubricant properties of a number of cerium and zinc thio- and oxythiomolybdates were also investigated. The cerium complexes, as additives in a lithium grease, showed excellent antiwear properties on both chrome tool and stainless steel. However, their nonstiochiometric composition and tendency to form hydrates caused complications during synthesis and evaluation of properties. The zinc complexes were found to be even more promising as antiwear additives, especially for high temperture use on stainless steel. GRA

N83-15472# Brunel Univ., Uxbridge (England). Dept. of Non-Metallic Materials.

CRYSTALLINE DEFECTS AND DEFORMATION MECHANISMS IN SEMI-CRYSTALLINE POLYMERS Final Technical Report, 1 Sep. 1980 - 31 May 1982

A. Hunter and M. Bevis London Army May 1982 25 p refs

(Contract DAJA37-80-C-0497; DA Proj. 1T1-61102-BH-57)

(AD-A120097) Avail: NTIS HC A02/MF A01 CSCL 11/9

The microstructure and subsequent mechanisms of deformation in polyethylene spherulites is very dependent on the method of spherulitic film preparation. Slowly cooled spherulites have been previously investigated in detail by transmission electron microscopy and diffraction, whereas the present work has been primarily concerned with the reproducible preparation of rapidly cooled high density polyethylene films which exihibit a banded spherulite morphology. Techniques for the preparation of deformed thin polyethylene films and their subsequent examination by scanning transmission electron microscopy and diffraction have been developed. Fine differences in the spherulite morphology have been identified, as have the differences between the operative deformation mechanisms in rapidly and slowly cooled spherulitic films. GRA

N83-15473# Akron Univ., Ohio. Inst. of Polymer Sciences.
DIFFUSION AND EQUILIBRIUM SWELLING OF MACROMOLECULAR NETWORKS BY THEIR LINEAR HOMOLOGS
A. N. Gent and R. H. Tobias Oct. 1982 37 p refs
(Contract N00014-76-C-0408)
(AD-A120695; TR-20) Avail: NTIS HC A03/MF A01 CSCL 20/8

Polydimethylsiloxane (PDMS) networks having strands of molecular weight in the range 11,000-36,000 have been prepared by endlinking linear PDMS molecules of these molecular weights with a tetrafunctional linking agent. Absorption of a series of homologous linear PDMS molecules by the resulting PDMS networks has been investigated. The diffusion coefficients at 70 deg were found to be rather large, 1x10 to the minus 12th power - 6x10 to the minus 12th power m(2)/s, and approximately inversely proportional to the molecular weight of the diffusion liquid, over the range 5,000-38,000. The amounts of liquid absorbed at equilibrium was relatively small, 10% - 80% in good agreement in all cases with an especially simple version of the Flory-Huggins theory when the heat of mixing is made vanishingly small and only entropic terms are retained. GRA

N83-15474# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.
MECHANICAL PROPERTIES VERSUS MORPHOLOGY OF ORDERED POLYMERS, VOLUME 3, PART 1 Interim Report, 1 Sep. 1980 - 30 Aug. 1981
Edwin L. Thomas, R. J. Farris, and S. L. Hsu Wright-Patterson AFB, Ohio AFWAL Aug. 1982 177 p refs 3 Vol.
(Contract F33615-78-C-5175; AF Proj. 2419)
(AD-A120709; AFWAL-TR-80-4045-Vol-3-1) Avail: NTIS HC A09/MF A01 CSCL 07/4

Morphological techniques in conjunction with mechanical testing have been used to elucidate the relationships between mechanical properties and sample microstructures and to use this knowledge to obtain the maximum in strength and modulus for rigid rod polymer fiber and film. The fibers and films of poly (p-phenylene benzobisthiazole) (PBT) which have been investigated were produced at Celanese Research Corporation from liquid crystalline solutions using a dry-jet wet spin process for fibers and either shear or extrusion for films. Microstructural studies involve predominantly scanning and transmission electron microscopy, small and wide X-ray scattering and electron diffraction. Mechanical behavior has been assessed in tensile, fatigue, bending and torsion tests. Tensile properties have been measured over the range-100 C to +200 C. Studies of low molecular weight model compounds and poly-p-phenylene benzo-bisoxazole (PBO) and PBT polymers in solution and solid states have also done by laser Raman and Fourier transform infrared spectroscopy. GRA

N83-15475# DL Labs., New York, N.Y.
EVALUATION OF WATER-BORNE LEAD AND CHROMIUM FREE ANTI-CORROSIVE PRIMERS Final Report, 26 Jun. 1981 - 30 Jul. 1982
Sidney B. Levinson, Saul Spindel, and Jerry H. Willner 30 Jul. 1982 70 p
(Contract DAAK70-81-C-0100)
(AD-A120833; DL-6010) Avail: NTIS HC A04/MF A01 CSCL 15/2

US AMERADCOM is striving to replace primers used on Army Equipment with low VOC coatings in order to meet air quality regulations and to eliminate lead and Chromium VI. 35 water-borne, lead and chromium-free formulations and proprietary primers were evaluated. One formulation and one proprietary primer are almost equal to TT-P-1757 in corrosion resistance. Another formulation and two proprietary primers are acceptable with minor modifications. Six other formulations and one proprietary primer are acceptable for use on aluminum but not on steel. GRA

N83-15476# Pennsylvania Univ., Philadelphia. Dept. of Physics.
CONTROL OF ELECTRONIC, MAGNETIC AND OPTICAL PROPERTIES OF DOPED POLYACETYLENE CONDUCTORS THROUGH INDUCED DEFECTS Final Report, 1 Mar. 1981 - 30 Jun. 1982
Alan J. Heeger 1 Oct. 1982 7 p refs
(Contract DAAG29-81-K-0058)
(AD-A120431; ARO-17716.7-MS) Avail: NTIS HC A02/MF A01 CSCL 11/9

The experimental studies carried out under this program focused on the use of particle irradiation to induce defects in polyacetylene. The program evolved into a related detailed study of the photoexcitations in (CH) sub x including luminescence, photoconductivity and Raman scattering. GRA

N83-15477# Oak Ridge National Lab., Tenn.
CHANGES IN THE PROPERTIES OF POLYMER FILMS WHEN EXPOSED TO TYPICAL TRANSFORMER ENVIRONMENTS
H. E. McCoy, Jr. and C. R. Brinkman 1981 25 p refs Presented at Intern. Conf. on Environ. Degradation of Engr. Mater., Blacksburg, Va., 21 Sep. 1981
(Contract W-7405-eng-26)
(DE81-030919; CONF-810913-9) Avail: NTIS HC A02/MF A01

Polymer films are considered for several insulator applications where they will operate at temperatures above ambient. Test equipment was developed for exposing polymer samples under stress to SF6 containing various amounts of water and Freon 113. Samples of polyethylene terephthalate, polycarbonate, polyethersulfone, polyparabanic acid, and polyimide were exposed at temperatures from 70 to 160 C for 2000 h and were evaluated by visual examination, tensile tests, metallographic examination, and electrical breakdown tests. It was found that the properties of polycarbonate and polyethylene terephthalate degraded considerably due to exposure, the mechanical properties of polyethersulfone and polyparabanic acid changed some, and the properties of polyimide were uneffected. DOE

N83-15478# Los Alamos Scientific Lab., N. Mex.
POLYMER COATINGS OF GLASS MICROBALLOONS LEVITATED IN A FOCUSED ACOUSTIC FIELD
A. T. Young, M. C. Lee, I. A. Feng, D. D. Ellman, and T. G. Wang 1981 5 p refs Presented at Ann. Meeting of the Mater. Res. Soc., Boston, 16 Nov. 1981
(Contract W-7405-eng-36)
(DE82-002625; LA-UR-81-3262; CONF-811122-8) Avail: NTIS HC A02/MF A01

Inertial confinement fusion glass microballoons (GMBs) levitated in a focusing radiator acoustic device can be coated with liquid materials by deploying the liquid into the levitation field with a stepped horn atomizer. The GMB can be forced to the center of the coating liquid with a strong acoustically generated centering force. Water solutions of organic polymers, uv-curable liquid organic monomers, and paraffin waxes were used to prepare solid coatings on the surface of GMBs using this technique. DOE

N83-15479# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
FACTORS AFFECTING THE IRON OXIDATION STATE AND FOAMING IN SRP WASTE GLASS
M. J. Plodinec 1981 14 p refs Presented at Electrochem. Soc. Conf., Denver, 11 Oct. 1981
(Contract DE-AC09-76SR-00001)
(DE82-001799; DP-MS-81-21; CONF-811013-6) Avail: NTIS HC A02/MF A01

Foaming, or the uncontrolled release of gas (primarily O2) during melting, has been a problem in vitrification tests with simulated Savannah River Plant waste. The main source of O2 is the reduction of polyvalent cations such as Mn4+ and Fe3+ at high temperatures. The factors that affect the Fe3+/Fe2+ equilibrium and their relation to foaming were determined. The most important factors are total iron concentration, interactions between iron and other polyvalent cations, and the basicity of the glass. Addition of a reducing agent and the use of a less reducing glass have prevented foaming problems in recent continuous melter tests. DOE

N83-15480# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
AUTOMATED X-RAY DIFFRACTION TECHNIQUE FOR QUANTITATIVE DETERMINATION OF CRYSTALLINE PHASES IN GLASS CONTAINING SIMULATED NUCLEAR WASTE
B. C. Osgood, W. C. Mosley, and F. A. Cochrane 1981 21 p refs Presented at the Am. Ceramic Soc. Conf., Newport Beach, Calif., 25 Oct. 1981
(Contract DE-AC09-76SR-00001)
(DE82-002257; DP-MS-81-56; CONF-811088-1) Avail: NTIS HC A02/MF A01

The Savannah River Laboratory is developing methods for incorporating nuclear defense waste into a suitable solid form for ultimate disposal. Boroscilicate glass is currently the reference form for this study. Crystalline phases can influence important properties of the glass. Therefore, automated X-ray diffraction techniques have been developed to identify and determine the percentages of crystalline phases in the glass form for defense waste. DOE

N83-15481# Sandia Labs., Albuquerque, N. Mex.
FRACTURE-MECHANICS ANALYSIS OF GLASS CERAMICS
J. J. Mecholsky 1981 33 p refs Presented at the 83rd Symp. on Nucleation and Crystallization in Glasses, Washington, D.C., 3 May 1981
(Contract DE-AC04-76DP-00789)
(DE81-030125; SAND-80-2710C; CONF-810528-13) Avail: NTIS HC A03/MF A01

Elastic modulus, fracture toughness and strength, and critical flaw size were measured as a function of microstructure, crystal morphology, and percent crystallization in silicate and nonsilicate glass ceramics. Calculations of the critical stress intensity factor (fracture toughness), K/sub IC/, from measurements of the critical flaw size and fracture strength of flexural bars (0.5 to 3.0 MPa m/ sup 1/2/) were compared to independent measurements of K/sub IC/ from fracture mechanics specimens (double cantilever beam and the short rod specimen). Measurement of fracture surface features on fine-grained glass ceramic materials showed that increases in fracture toughness with increased crystallization at a constant critical flaw size was due to microcracking and internal stress at the grain boundaries. DOE

N83-15482# Sandia Labs., Albuquerque, N. Mex.
OPTICAL IMAGING AND INFORMATION STORAGE IN ION IMPLANTED FERROELECTRIC CERAMICS
P. S. Peercy and C. E. Land Nov. 1981 26 p refs Presented at the Ann. Meeting of the Mater. Res. Soc., Boston, 16 Nov. 1981 Sponsored in part by Army Research Office
(Contract DE-AC04-76DP-00789)
(DE82-003341; SAND-81-1515C; CONF-811122-17) Avail: NTIS HC A02/MF A01

Photographic images can be stored in ferroelectric-phase lead lanthanum zirconate titanate (PLZT) ceramics using a novel photoferroelectric effect. These images are nonvolatile but erasable and can be switched from positive to negative by application of an electric field. The photosensitivity of ferroelectric PLZT is dramatically improved by ion implantation into the surface exposed to image light. For example, the intrinsic photosensitivity to near-UV light is increased by as much as four orders of magnitude by complantation with Ar and Ne. The increased photosensitivity results from implantation-induced decreases in dark conductivity and dielectric constant in the implated layer. Furthermore, the increased photoferroelectric sensitivity was recently been extended from the near-UV to the visible spectrum by implants of Al and Cr. Ion-implanted PLZT is the most sensitive, nonvolatile, selectivity-erasable image storage medium currently known. DOE

N83-15253# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGN CONSIDERATIONS ON GLASS FIBER REINFORCED PLASTIC COMPOSITE STRUCTURES
Zhu Yiling (Shanghai GRP Research Inst.) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 61-77 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N83-15483*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF ULTRAVIOLET SPECTROPHOTOMETRY FOR SIMULTANEOUS ANALYSIS OF ALKYLBENZENES, ALKYLNAPHTHALENES, ALKYLANTHRACENES/PHENANTHRENES AND TOTAL AROMATICS IN MID-DISTILLATE FUELS
Walter S. Kim and Gary T. Seng Nov. 1982 47 p refs
(NASA-TM-83032; E-1470; NAS 1.15:83032) Avail: NTIS HC A03/MF A01 CSCL 21D

A rapid ultraviolet spectrophotometric method for the simultaneous determination of aromatics in middistillate fuels was developed and evaluated. In this method, alkylbenzenes, alkylnaphthalenes, alkylanthracenes/phenanthracenes and total aromatics were determined from ultraviolet spectra of the fuels. The accuracy and precision were determined using simulated standard fuels with known compositions. The total aromatics fraction accuracy was 5% for a Jet A type fuel and 0.6% for a broadened properties jet turbine type fuel. Precision, expressed as relative standard deviations, ranged from 2.9% for the alkylanthracenes/phenanthrenes to 15.3% for the alkylbenzenes. The accuracy, however, was less for actual fuel samples when compared to the results obtained by a mass spectrometric method. In addition, the ASTM D-1840 method for naphthalenes by ultraviolet spectroscopy was evaluated. S.L.

N83-15484# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SHOCK IGNITION SENSITIVITY OF MULTIPLY-SHOCKED TNT Final Report
V. M. Boyle and D. I. Pilarski Jul. 1982 35 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A120045; AD-F300067; ARBRL-TR-02415) Avail: NTIS HC A03/MF A01 CSCL 21/2

The shock ignition sensitivity of pressed TNT was decreased by shocking it with a leading low pressure wave (.2 - 1.0 GPa) which was followed within several microseconds by one or two shock waves which gave a maximum pressure of 2.7 GPa. The velocity of the reaction products from the downstream free surface of the impacted TNT was used as a measure of relative reaction. A system is described for producing a series of shocks increasing amplitude within a target by impacting it with a layered projectile. Several firings were also made usng cast TNT. The results of these firings indicate that the shock ignition sensitivity of cast TNT is also decreased by multiple shocking. GRA

N83-15485# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hardthausen (West Germany).
A GAS GENERATOR CONCEPT FOR BORON FURLED MISSILES: ASSESSMENT OF THE BORON PARTICLE IGNITION BY MEANS OF THE TEMPERATURE OF A RESTRICTED THERMODYNAMICAL EQUILIBRIUM
Dirk Meinkohn and Jurgen W. Bergmann Feb. 1982 24 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal, Jun. 1983
Avail: NTIS HC A02/MF A01

The assumption that a certain particle temperature is the most important prerequisite for boron particle ignition implies the necessity of controlling the attainment of this temperature in the

course of the chosen heat up process. The hybrid gas generator concept is chosen for particle heat up process. The hybrid gas generator concept is chosen for particle heat up. The resulting thermal state of the boron particles is characterized by a T*-temperature, which is derived for a restricted thermodynamical equilibrium defined by the suppression of chemical contact between the reacting substances of the gas generator and the thermally coupled boron fuel, which is to be combusted in a secondary airbreathing combustion chamber. A temperature diagram is derived, in which the ignition readiness of the boron particulate fuel is displayed in terms of a T*-temperature depending on a varied fraction of the boron fuel, which is set to be combusted in the primary process in order to heat up the remainder of the boron. S.L.

N83-15486# Naval Surface Weapons Center, White Oak, Md.
NOTES FROM LECTURES ON DETONATION PHYSICS
Frank J. Zerilli Oct. 1981 207 p refs
(AD-A119965; AD-F500076; NSWC/MP-81-399) Avail: NTIS HC A10/MF A01 CSCL 19/1

This is a series of lecture notes on the subject of detonation physics. The topics covered include a historical summary from the perspective of the White Oak Laboratory of NSWC dating from 1940, the basic conservation equations for shock and detonation waves, the gamma law equation of state, critical diameter and critical shock initiating pressure, detonability curves and the classification of explosives, the effects of particle size, temperature, temperature cycling, chemical composition, the large scale and small scale gap tests, the wedge test, characterization of shock sensitivity, estimating and measuring detonation pressures, the electro-magnetic velocity measurement method, the continuous wire method, and reaction zone lengths and reaction times. GRA

N83-15487# Army Armament Research and Development Command, Dover, N. J. Technical Support Directorate.
RENOVATED PROGRAM FOR PRODUCTION OF XM29 PROPELLANT GRAINS FOR SPARROW MISSILE
Herman J. Frigand Sep. 1982 47 p refs
(AD-A119981; AD-E400904; ARTSD-TR-82001) Avail: NTIS HC A03/MF A01 CSCL 21/2

In the past, serious problems had arisen relevant to the fast burning characteristics of XM29 propellant grains produced for the Sparrow missile. An exploratory program was therefore conducted to find ways and means of producing slower burning grains which compiled with specification requirements of 40 seconds minimum burning time. A renovated program was developed which encompassed the strict surveillance of raw materials and oprating procedures in order to assure the production of grains with acceptable ballistic properties. GRA

N83-15488# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
FRICTION SENSITIVITY OF PRIMARY EXPLOSIVES Final Report
Joel Harris Sep. 1982 26 p refs
(AD-A119982; AD-E400899; ARLCD-TR-82012) Avail: NTIS HC A03/MF A01 CSCL 19/1

A Bundesanstalt fur Materialprufung (BAM) small friction tester, manufactured in West Germany, has been used to rank primary explosives in their order of friction sensitivity. Primary explosives RD 1333 lead azide, dextrinated lead stypanate, polyvinyl-alcohol (PVA)-lead azide, colloidal lead azide, norma lead styphnate, basic lead styphnate, potassium dinitrobenzofuroxan, and tetrazene were tested to determine the 10% and 50% probability of friction initiation. The 50% probability of initiation level was used to rank primary explosives for initiation of combustion by friction. The rankings for initiation by friction were compared with data for ranking primary explosives by impact sensitivity, autoignition temperature, and crystal density. Friction sensitivity values appeared to decrease with increase in the crystal density of primary explosives. Impact sensitivity and autoignition temperature values increased as the crystal density of primary explosives increased. GRA

N83-15489# Southwest Research Inst., San Antonio, Tex. Fuels and Lubricants Research Lab.
ASSESSMENT/REVIEW OF METHANOL TECHNOLOGY AND UTILIZATION AS A FUEL Interim Report, Oct. 1981 - Sep. 1982
G. H. Lee, L. L. Stavinoha, and R. G. Zoschak Jul. 1982 78 p refs
(Contract DAAK70-82-C-0001; DA Proj. 1L7-62733-AH-20)
(AD-A120109; AFLRL-161; SwRI-6800-121) Avail: NTIS HC A05/MF A01 CSCL 07/3

Alcohols, in particular methanol and ethanol, are currently being extensively studied for feasibility of use as neat fuels, fuel extenders, and/or octane improvers. This report provides a review of methanol technology and a preliminary assessment of its potential for use as a mobility/stationary equipment fuel. A high degree of technical feasibility has been indicated for both increased methanol production and use as a fuel, principally in burners, turbines, and spark ignition engines. Generally, the methanol fuel of choice for direct utilization is not neat methanol, but a methanol fuel containing materials such as iscpentane or gasoline (up to 10 covo1%) to improve cold start, volatility, and other fuel properties. Modifications of existing equipment are generally needed for direct use of fuel grade methanol except in fuel cells. Use of methanol at low concentrations as an additive or gasoline extender presents fewer problems of system corrosion and elastomer compatibility. A program to demonstrate the potential for utilization of methanol (both direct and as an extender) in DOD equipment has been recommended. Under this program, the Army would evaluate the equipment performance in various climates, test the equipment reliability/durability, and resolve related support questions on the safe and efficient storage, distribution, and use of methanol fuel. GRA

N83-15490# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE NUMERICAL ACCURACY OF HOMEGENEOUS SOLID PROPELLANT COMBUSTION MODELS Final Report
Martin S. Miller and Terence P. Coffee Oct. 1982 47 p refs
(DA Proj. 1L1-62618-AH-80)
(AD-A120657; AD-F300090; ARBRL-TR-02425) Avail: NTIS HC A03/MF A01 CSCL 19/1

Most theoretical treatments of solid propellant combustion assume a highly idealized mechanism: an exothermic surface decomposition reaction followed by a single exothermic gas-phase reaction. Despite its conceptual simplicity this mechanism does not permit an exact solution to the conservation equations. Published combustion models addressing the stated idealization rely on various approximation schemes which have never been tested for accuracy. This report examines the numerical reliability of a number of these schemes by direct comparison of model results with accurate numerical integrations of the conservation equations. Four propellant data sets which span a wide range of kinetics parameters were utilized. None of the approximations proved accurate for all the data sets but some models are quite accurate in certain limiting cases. The calculations provide a benchmark against which future models might be tested. GRA

N83-15491# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A FRESH LOOK AT THE CLASSICAL APPROACH TO HOMOGENEOUS SOLID PROPELLANT COMBUSTION MODELING Final Report
Martin S. Miller and Terence P. Coffee Oct. 1982 48 p refs
(DA Proj. 1L1-62618-AH-80)
(AD-A120656; AD-F300093; ARBRL-TR-02424) Avail: NTIS HC A03/MF A01 CSCL 21/9

The term 'classical approach' is applied to those modeling efforts that use the experimental burning rate as the sole criterion for validation. The utility and limitations of this approach are discussed. It is argued that previous applications of the Classical

Approach have too narrowly focused on a numerical match between model and actual burning rates. The result is an incomplete understanding of the full range of burning rate behavior implied by the basic idealization of the burning mechanism. Since a comparison of broad trends is of greatest heuristic interest, five different propellant data sets are developed which span a wide range of kinetics values. Accurate calculations of the burning rate pressure and temperature dependence are made and parallels drawn with actual propellant behavior. Likely weaknesses in the basic idealization are then identified. GRA

N83-15492# Applied Combustion Technology, Inc., Orlando, Fla.
EXPANDED IGNITION EFFECTIVENESS TESTS OF SELECTED IGNITER MATERIALS WITH NAVY PROPELLANTS Final Report, Oct. 1981 - Sep. 1982
A. Michael Varney and John Martino Sep. 1982 113 p refs
(Contract N00174-81-C-0453)
(AD-A120790; ACT-TR-8136) Avail: NTIS HC A06/MF A01 CSCL 21/2

Diagnostic ignition experiments have been conducted using a high-pressure flow through combustor to evaluate the ignition effectiveness of black powder, boron potassium nitrate, magnesium-teflon-viton, nitrocellulose, and boron molybdenum trioxide with four propellants - NACO, NOSOL-318, NOSOL-363 and LOVA. Over 250 experiments have been conducted to determine the ability of various igniter materials to ignite gun propellants beyond the immediate vicinity of the gun igniter - that is, after filtering through and being cooled by an inert propellant simulant zone positioned between the igniter and the live propellant . The ignition effectiveness has been determined quantitatively by the amount of igniter thermal energy, based on its heat of explosion, required to ignite a propellant 50 percent of the time. Analyses and results are given which present the relative effectiveness of the igniter materials in terms of the different ignition stimuli (e.g., gases, liquids, and solids ratios). Author (GRA)

N83-15493# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
QUICK-LOOK STRUCTURAL ANALYSIS TECHNIQUES FOR SOLID ROCKET PROPELLANT GRAINS Special Report, Jan. - Jun. 1981
Russell A. Leighton May 1982 47 p refs
(AF Proj. 5730)
(AD-A119841; AFRPL-TR-81-80) Avail: NTIS HC A03/MF A01 CSCL 21/9

Software was developed to provide the means to perform a quick-look' preliminary motor structural analysis within the AFRPL. Preliminary structural analysis equations from the JANNAF Structural Integrity Handbook and Galcit 101, 'Fundamental Studies Relating to Systems Analyses of Solid Propellants' were implemented on the HP 9815A programmable calculator as a basis for the software. For analysis of a motor undergoing a thermal transient load, software was written to provide the means to calculate an effective modulus, based on linear viscoelastic theory, for use in the 'quick look' analysis. Supporting software was also written to provide graphical input of data and to correct any distortions appearing in supplied data. Finally, results from a simple, slow cooldown problem were obtaned from a finite element analysis using the TEXGAP 2D computer code to verify the usefulness and accuracy of the 'quick-look' analysis and supporting software. Author (GRA)

N83-15494# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Analysis Lab.
PROPELLANT SURVEILLANCE REPORT ANB-3066 PROPELLANT Semiannual Report
Elizabeth M. Dalaba Aug. 1982 232 p refs
(AD-A120429; MANPA-473(82)) Avail: NTIS HC A11/MF A01 CSCL 21/9

This report contains test results from LGM-30 F and G, Stage 2 and Stage 3 propellant. Data are shown in regression plots, special types of plots such as those of gradient stress relaxation and constant load testing. Occasionally, data are presented in Tabular form. The differences between polymers used in the propellant are given in the analysis of covariance tables. Graphically, the differences are most evident in gradient stress relaxation modulus. Author (GRA)

N83-15495# National Fertilizer Development Center, Muscle Shoals, Ala.
THE TENNESSEE VALLEY AUTHORITY'S BIOMASS FUELS PROGRAM
John M. Stinson 1981 21 p refs Presented at Interagency Workshop on Biomass, Washington, D.C., 14-15 May 1981
(DE81-904161; Circ-Z-120; CONF-8105119) Avail: NTIS HC A02/MF A01

Information and processes that allow effective use of biomass (principally wood) by industry are investigated. Hardwoods are converted to ethanol by acid hydrolysis. An acid hydrolysis process which should decrease cost of production and improve process efficiency is studied. Direct combustion of wood in commercial and industrial furnace/boilers to replace oil and natural gas is feasible and is receiving considerable attention. Technical assistance is provided to encourage commercialization. Other activities include: (1) development of wood resource information and harvesting techniques; (2) determining productivity of nonwood biomass crops for ethanol production and potential land availability for biomass crops; (3) development of a farm scale fuel alcohol unit to utilize various nonwood feedstocks; and (4) marketing and distribution assessments. DOE

N83-15496# Los Alamos Scientific Lab., N. Mex.
ANALYSIS OF PREBURN THREE-DIMENSIONAL FLOW PATTERNS IN UNDERGROUND COAL CONVERSION
Bryan J. Travis and H. Eric Nuttall (New Mexico Univ., Albuquerque) 1981 9 p refs Presented at the 7th Underground Coal Conversion Symp., Fallen Leaf Lake, Calif., 8-11 Sep. 1981 Sponsored in part by the Public Service Co. and Western Coal Co.
(Contract W-7405-eng-36)
(DE82-002405; LA-UR-81-2933; CONF-810923-12) Avail: NTIS HC A02/MF A01

A three dimensional numerical study was performed to better elucidate the rather complex flow patterns that can occur during the bed preparation stage of underground coal gasification when the linked vertical well method is applied. The important effects of the 3-D geometry, gravity, anisotropy, pressure dependent permeability, and dynamic two phase air/water flow are discussed. For the first time the dynamic, 3-D growth of the air bubble (i.e., the dewatered region) is studied under simulated field conditions for western subbituminous coal. Interpretation of the 3-D flow and tracer patterns is an important element in an effective site characterization program. The numerical code used in these studies WAFE3D, was developed to compute multiphase, multicomponent mass and heat transport in porous/fractured geological media. The code solves the time dependent 3-D conservation equations for mass, momentum, and energy using an integrated finite difference implicit numerical scheme. DOE

N83-15497# Battelle Columbus Labs., Onio.
POTENTIAL FOR USE OF PEAT BLENDS WITH COAL FOR ELECTRIC POWER GENERATION Final Technical Report, Apr. 1981
Donald Anson, Jeannette Murin, and Herbert R. Hazard 1981 115 p refs
(Contract DE-AC18-80FC-10231)
(DE82-003634; DOE/PC/10231-T1) Avail: NTIS HC A06/MF A01

The possible use of peat and coal blends in utility boilers was studied. From fuel and ash properties estimates were made of the changes from coal firing practice that would be required in boiler design and fuel preparation. Boiler fouling, slagging and efficiency effects were predicted and compared with behavior of plants operating on coal or peat alone. It is expected that blends containing 50 percent peat would require relatively minor design changes from coal firing practice, but the firing of peat calls for substantially different design approaches. DOE

N83-15498# Los Alamos Scientific Lab., N. Mex.
METHANE HYDRATE GAS PRODUCTION: EVALUATING AND EXPLOITING THE SOLID GAS RESOURCE
Patrick L. McGuire 1981 23 p refs Presented at the 4th Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 14-16 Dec. 1981
(Contract W-7405-eng-36)
(DE82-004373; LA-UR-81-3461; CONF-811212-3) Avail: NTIS HC A02/MF A01

Two methods of producing gas from hydrate deposits by the injection of hot water or steam are discussed. The feasibility of hydraulic fracturing and pressure reduction as a hydrate gas production technique is discussed. A hydraulic fracturing technique suitable for hydrate reservoirs and a system for coring hydrate reservoirs are also described. DOE

N83-15499# Oak Ridge National Lab., Tenn. Engineering Div.
MODIFICATION OF FEED/EFFLUENT FLOW WORK EXCHANGERS FOR SLURRY SERVICE AND POWER RECOVERY IN COAL LIQUEFACTION PROCESSES
Joel R. Horton 1981 17 p Presented at the Winter Ann. Meeting of the ASME Technol. and Soc. Div., Washington, 15-19 Nov. 1981
(Contract W-7405-eng-26)
(DE82-004114; Y/EN-511; CONF-811101-15) Avail: NTIS HC A02/MF A01

Process and equipment modifications necessary for application of modified flow work exchangers in coal liquefaction processes are reviewed. A discussion is provided on flow work exchanger-like devices such as the Pipefeeder and the Hydro-hoist. The benefits in minimizing the use of or elimination of critical and problem equipment in conventional coal liquefaction plants such as pressure letdown valves and large high head slurry pumps are compared with the most critical problems with slurry feed/effluent flow work exchangers. Performance of disc type slurry valves which are being considered for flow work exchangers in slurry service is discussed. A preliminary assessment of the cost/benefits of power recovery in coal liquefaction utilizing feed/effluent work flow exchangers is discussed. DOE

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N83-15500# Naval Facilities Engineering Command, Alexandria, Va.
STRUCTURAL ENGINEERING. LOADS. DESIGN MANUAL 2.2 Final Report
Nov. 1981 85 p refs
(AD-A119514; NAVFAC-DM-2.2) Avail: NTIS HC A05/MF A01 CSCL 13/13

Criteria for the estimation of loadings to be used in the design of civil engineering structures are presented. Criteria relating to combining loads for purposes of design and suggested limitations on deflections also are presented. Author

N83-15501# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
MEMBRANE-SOIL COMPOSITE LAYERS IN THE DESIGN, CONSTRUCTION, AND PERFORMANCE OF AN EXPEDIENT BRIDGE AND APPROACH Final Report, Oct. 1976 - Jul. 1982
George L. Regan Sep. 1982 69 p refs
(DA Proj. 4A7-62719-AT-40)
(AD-A120563; WES/TR-GL-82-7) Avail: NTIS HC A04/MF A01 CSCL 13/13

There is a definite need to make use of locally available materials in construction to minimize time and cost of construction. This report described a technique for constructing bridge approaches, abutments, and piers using locally available soils and military stock membrane (T-16 and T-17). The construction of the bridge described in this report involves confining sand with T-16 and T-17 membrane to form the various structure units. After the approach, abutment, and piers were constructed, treated timber was used in construction of the stringers, decking, and tread. The bridge was constructed with a small labor force and a minimum amount of equipment. The construction was simple and fast, thus making it readily adaptable to conditions faced in the theater of operations. The bridge was built in 1977, and the performance was recorded for a period of approximately five years. During this time only minor scour problems developed around the piers and these problems were handled with a minimum of maintenance. GRA

N83-15502# California Univ., Livermore. Lawrence Livermore Lab.
SAFETY PROCEDURES FOR THE MFTF SUSTAINING-NEUTRAL-BEAM POWER SUPPLY
John W. Wilson 19 Oct. 1981 5 p refs Presented at 9th Symp. on Engr. Probl. of Fusion Res., Chicago, 26-29, 1981 Submitted for publication
(Contract W-7405-eng-48)
(DE82-002056; UCRL-86072; CONF-811040-48) Avail: NTIS HC A02/MF A01

The mirror fusion test facility sustaining neutral beam power supply comprises a number of sources of potentially hazardous electrical energy in a small physical area. Power is handled at 80 kV dc, 10 A. Power for these systems is furnished from two separate 480 V distribution systems and a 13.8 kV distribution system. a defense in depth approach is used; interlocks are provided in the hardware to make it difficult to gain access to an energized circuit, and the operating procedure includes precautions which would protect personnel even if no interlocks were working. The complexity of the system implies a complex operating procedure, and this potential complexity is controlled by presenting the procedure in a modular form using 37 separate checklists for specific operations. The checklists are presented in flowchart form, so contingencies can be handled at the lowest possible level without compromising safety. DOE

N83-15503# California Univ., Livermore. Lawrence Livermore Lab.
PROGRAMMABLE CONTROLLERS REPLACE RELAYS IN MFTF-B PERSONNEL-SAFETY INTERLOCKS
James D. Branum 20 Oct. 1981 4 p refs Presented at 9th Symp. on Engr. Probl. of Fusion Res., Chicago, 26-29 Oct. 1981 Submitted for publication
(Contract W-7405-eng-48)
(DE82-002054; UCRL-86066; CONF-811040-45) Avail: NTIS HC A02/MF A01

A new approach for implementing personnel safety interlocks logic using industrial-type programmable controllers is described. The logic for all personnel safety interlocks except those totally internal to a subsystem is implemented in two non-redundant controllers. A high degree of fail-safe reliability is achieved by augmenting the protective features intrinsic to each controller with those provided by a small amount of external support hardware. The controllers are interfaced to the host computer system via fiber optic data links to enable display of interlock and overall system status on the control room graphic displays. When fully implemented, the controllers will perform the equivalent of over 2000 discrete relay functions. DOE

N83-15504# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
PROBLEMS IN BEARINGS AND LUBRICATION
London Aug. 1982 459 p refs In ENGLISH and FRENCH Symp. held in Ottawa, 31 May - 3 Jun. 1982
(AGARD-CP-323; ISBN-92-835-0318-9) Avail: NTIS HC A20/MF A01

Performance prediction and performance limitation problems in bearing and lubrication technology, manifested in the life, durability, and design of engines and transmissions, are addressed. For individual titles, see N83-15505 through N83-15540.

N83-15505# Anderson (William J.), North Olmsted, Ohio.
BEARINGS: TECHNOLOGY AND NEEDS c37
William J. Anderson *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 16 p refs Previously announced as N82-26679 (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

A brief status report on bearing technology and present and near-term future problems that warrant research support is presented. For rolling element bearings a material with improved fracture toughness, life data in the low Lambda region, a comprehensive failure theory verified by life data and incorporated into dynamic analyses, and an improved corrosion resistant alloy are perceived as important needs. For hydrodynamic bearings better definition of cavitation boundaries and pressure distributions for squeeze film dampers, and geometry optimization for minimum power loss in turbulent film bearings are needed. For gas film bearings, foil bearing geometries that form more nearly optimum film shapes for maximum load capacity, and more effective surface protective coatings for high temperature operation are needed.
Author

N83-15506# Defence Research Establishment Pacific, Victoria (British Columbia).
DETECTION AND DIAGNOSIS OF BEARING DETERIORATION IN AIRCRAFT PROPULSION SYSTEMS BY WEAR DEBRIS ANALYSIS c38
C. A. Waggoner *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 13 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

Aspects of wear revealed by advanced analytical methods, and the manner in which these methods are being successfully applied to detect and diagnose bearing deterioration in aircraft propulsion machinery are reviewed.
Author

N83-15507# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.
INCREASING THE WEAR LIFE OF GAS TURBINE ENGINE ROLLER BEARINGS c37
P. F. Brown, L. J. Dobek, M. J. Carrano, R. A. Valori (Naval Air Propulsion Center, Trenton), and R. D. Dayton (AFWAL) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 14 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

Life limiting roller end wear of the eccentric type, which ultimately results in cage failure, was demonstrated in high speed rig tests to levels of 3.0 MDN. Seventeen parameters having the potential for influencing the skew action of the roller and its end wear were selected for experimental evaluation on a series of 124 mm experimental roller bearings. The corresponding statistical test plan is described and the essentials of a mathematical model are covered that ultimately defines the motion of the roller and its interaction with other parts of the bearing. The test results showed roller corner radius runout as having the most influence on wear with roller length to diameter ratio and end clearance demonstrating modest effects.
Author

N83-15508# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Mechanical Engineering.
CONDITION MONITORING OF BEARINGS: A MEASURING TECHNIQUE IN AN EXPERIMENTAL STAGE c38
M. J. W. Schouten *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 9 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

Two bearing measurement techniques are described. Thermodynamic measurement and measurement with thin film transducers are presented briefly. Both were used under laboratory conditions.
Author

N83-15509# Tribology Consultants, Inc., Paoli, Pa.
SILICON NITRIDE BEARING ELEMENTS FOR HIGH-SPEED HIGH-TEMPERATURE APPLICATIONS c37
Lewis B. Sibley *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 12 p refs Sponsored in part by Naval Air Systems Command, the Dept. of Army, Norton Co., Solar International and SKF Industries, Inc. (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

Progress to date in the use of silicon nitride ceramics for critical high-speed high-temperature ball and roller bearings is reviewed. The properties of silicon nitride are presented that make it an attractive bearing material compared to steel, such as high hardness, excellent high temperature performance and low density which reduces high speed bearing centrifugal loads and skidding. Design procedures are demonstrated for bearing applications using computer analysis codes to evaluate the cross-coupled effects of these material properties and bearing operating characteristics. Silicon nitride processing, inspection criteria and rolling-contact fatigue performance are reviewed. Successful test results are presented for an oil-lubricated hybrid silicon nitride bearing (silicon nitride balls with tool steel rings) in a 93,500 rpm turbine application. Solid lubricant development studies are reviewed, demonstrating low bearing wear at operating temperatures over 500 C. Therefore, it is expected that solid lubricated silicon nitride rolling bearings will find increasing application in future high-speed high-temperature aircraft systems.
Author

N83-15510# SKF Engineering and Research Centre, Nieuwegein (Netherlands). Material Development Dept.
LIGHTWEIGHT MATERIALS FOR ROLLING ELEMENTS IN AIRCRAFT BEARINGS c37
R. T. Cundill and F. Giordano (RIV-SKF Industrie S.p.A.) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 10 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

Using in-house experience with powder metallurgy, two approaches in the development of lightweight rolling elements were followed. Balls were made from both silicon nitride and proprietary composite material using process routes based on hot isostatic compaction. The composite material consisted of titanium carbide in a superalloy matrix and the finished balls had densities of 5.4 to 5.75 g/cc with hardness values above 1500 Hv. The performance of silicon nitide balls was compared with that of T1 tool steel balls in a test in which two mainshaft bearings were run at progressively increasing loads and speeds. Inspection after testing showed that there was much less distortion of raceway profiles in the bearing with silicon nitride balls indicating better kinematic behavior. As a consequence, the silicon nitride balls showed little change in physical form, whereas there was marked deterioration of the tool steel balls for the bearing design and test conditions considered.
Author

N83-15511# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
THE OIL/AIR SYSTEM OF A MODERN FIGHTER AIRCRAFT ENGINE c07
J. Schmidt, W. K. Hank, A. Klein, and K. Maier *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 19 p ref (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

The specification requirements of the oil/air system of modern fighter aircraft engine are defined and interpreted. Taking a three-spool engine as an example, the basic features of the design and functioning of the oil/air system are explained. The importance of the sealing air system and of its reliable computation is demonstrated. The advantages and disadvantages of interconnected and separated bearing chambers are pointed out. Attention is drawn to the vent system and to some special conditions of the turbine bearing chamber. Problems of highly loaded bearings are dealt with in some detail in view of a long bearing life, in particular the optimization of the oil supply and the bearing behavor in the event of an oil supply interruption. Finally, the reasons and consequences of a possible bearing chamber overheating are described as well as means to avoid such overheating.
Author

N83-15512*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LUBRICATION OF 35-MILLIMETER-BORE BALL BEARINGS OF SEVERAL DESIGNS AT SPEEDS TO 2.5 MILLION DN c37
Hans R. Signer (Industrial Tectonics, Inc.) and Frederick T. Schuller *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 15 p refs (For primary document see N83-15504 06-31)
(Contract NAS3-19779)
Avail: NTIS HC A20/MF A01 CSCL 13I

Parametric tests were conducted with 35mm bore, angular contact ball bearings with either a single or double-outer-land-guided cage. The bearings were either lubricated by oil jets or employed inner ring lubrication. Outer ring cooling was added in selected tests. Test conditions were a radial load of 222 N (50 lb) and/or a thrust load of 667 N (150 lb), shaft speeds to 72,000 rpm, and an oil inlet temperature of 394 K (250 F). Lubricant flow to the bearing ranged rom 300 to 1900 cc/min (0.08 to 0.50 gal/min). All bearings were successfully run at speeds to 2.5 million DN. Increasing the lubricant flow decreased bearing ring temperatures but increased bearing power loss. The power loss and race temperatures of a jet lubricated bearing with double-outer-land-guided cage were always higher than those of the single-land-guided-design at similar test conditions. The lowest bearing operating temperatures were achieved when inner ring lubication and outer ring cooling were combined. Cage slip of a double-outer-land-guided cage was approximately twice that of a single-outer-land-guided cage. Author

N83-15513# Cranfield Inst. of Tech., Bedfordshire (England). School of Mechanical Engineering.
MITIGATION OF THERMAL HAZARDS IN ROLLING CONTACT BEARINGS THROUGH CORRELATED COMPUTER ANALYSIS c37
V. A. Schwarz and B. R. Reason *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 15 p refs Sponsored in part by Escola Federal de Engenharia de Itajuba and CAPES (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

Investigations on the development of a predictive computer program for establishing the likelihood of thermal hazards in rolling contract bearing assemblies are outlined. Based on extensive experimental investigations carried out on a multi-capability test rig, the necessary data was established, resulting in a program capable of predicting temperature distributions within bearing units operating under a wide variety of industrial conditions. Author

N83-15514*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELASTOHYDRODYNAMIC LUBRICATION OF ELLIPTICAL CONTACTS c37
Bernard J. Hamrock *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 14 p refs Presented at the 1st Symp. INTERTRIBO, Stvbske Pleso Czechoslovakia, 27-29 Apr. 1981 (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

Fully flooded, elastohydrodynamically lubricated, elliptical contacts are discussed. The relevant equations used in the elastohydrodynamic lubrication (EHL) of elliptical contacts are briefly described. Film thickness equations are developed for materials of high elastic modulus, such as metal, and for materials of low elastic modulus, such as rubber. In addition to the film thickness equations that are developed, plots of pressure and film thickness are presented. A theoretical study of the influence of lubricant starvation on film thickness and pressure in hard and soft elliptical elastohydrodynamic contacts is presented. From the results for both hard and soft EHL contacts a simple and important dimensionless inlet boundary distance is specified. It is also found that the film thickness for a starved condition can be written in dimensionless terms as a function of the inlet distance parameter and the film thickness for a fully flooded condition. contour plots of pressure and film thickness in and around the contact are shown for fully flooded and starved conditions. The theoretical findings are compared directly with results obtained experimentally. Author

N83-15515# Institut National des Sciences Appliquees de Lyon, Villeurbanne (France). Lab. de Mecanique des Contacts.
FILM THICKNESS AND FRICTION ON ENERGY IN THE ELASTOHYDRODYNAMIC REGIME IN THE CONTACT OF A BALL AND THE PATH OF A ROLLING DISK [EPAISSEUR DU FILM ET FORCE DE FROTTEMENT EN REGIME ELASTOHYDRODYNAMIQUE DANS LE CONTACT BILLE-CHEMIN DE BAGUE D'UN ROULEMENT] c37
Gerard Dalmaz and Nabil Gadallah *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 12 p refs In FRENCH Sponsored in part by Direction des Recherches et Moyens d'Essais (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

The elastohydrodynamic lubrication of elliptic contacts, such as those between a ball and the path of a rolling ring with oblique contact, was studied on a high precision simulation device which permitted simultaneous measurement, at ambient temperature, of the normal load, the energy of tangential friction, the velocities, and the film thickness by an interferometric method. Results show that for a mineral oil, elastohydrodynamic theory can be extended to very high pressure (2 GPA). The effects of sliding velocity and of pivoting superposed on the rolling velocities have little effect on film thickness but considerably decrease the friction energy. Under these conditions, the film behaves as an amorphous solid. Friction energy was theoretically calculated in the elastohydrodynamic regime using the nonlinear isotherm model of Maxwell, Johnson, and Tevaarwerk. The Daniels model used to compute the heat conduction across the film thickness, and the Tevaarwerk model used to compute the covect convection in the case of pivoting are described. Transl. by A.R.H.

N83-15516# Leeds Univ. (England). Dept. of Mechanical Engineering.
THE LUBRICATION OF RIGID ELLIPSOIDS BY A PIEZO-VISCOUS FLUID c37
D. Dowson, J. F. Dunn, and C. M. Taylor *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 5 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

The lubrication of non-conformal contacts such as those occurring between gear teeth and the rolling elements and raceways of rolling bearings is influenced by two major physical effects. These are the extent to which the lubricant viscosity is enhanced due to the pressures to which it is subjected and the degree of elastic distortion of the bounding surfaces. Tribologists have defined four forms of fluid film lubrication depending on the extent of these effects, namely; rigid (solids) - isovicous (lubricant); elastic-iso-viscous; elastic-piezo-viscous; and rigid-piezo-viscous. The latter regime of lubrication has not previously been analyzed for point contacts with the same general set of conditions as have been applied to the other forms. Such an analysis has been undertaken here and the results are presented in a formula enabling the limiting minimum film thickness to be calculated directly. Author

N83-15517# Timken Co., Canton, Ohio.
REGIMES OF FLUID FLIM LUBRICATION AT THE RIB-ROLLER CONTACT IN A TAPERED ROLLER BEARING c37
C. L. Swingler *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 10 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

A recent analysis for determining the regime of lubrication in elliptical contacts is applied to the rib roller contact of axially loaded tapered roller bearings. The results indicate that the contact operates in either the isoviscous-rigid or isoviscous-elastic regimes depending on the conditions of load and speed. Although the corresponding calculated film thicknesses are an order of magnitude or more greater than those predicted by the traditionally

adopted EHD theory, actual lubrication conditions may be marginal due to the effects of sliding and starvation at the rib. Author

N83-15518# State Univ. of Gent (Belgium). Lab. of Machines and Machine Construction.
THE INFLUENCE OF THE SHEAR THINNING EFFECTS OF NON-NEWTONIAN OILS ON THE PERFORMANCE OF FINITE LENGTH JOURNAL BEARINGS **c37**
M. Vermeulen and H. S. Yoo (INHA Univ., Incheon, Korea) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 15 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

The behavior of nonNewtonian lubricants in journal bearing is very complex. Previous results for considering the shear thinning phenomena were negative for nonNewtonian lubricants, which was not in agreement with experiments. In this paper we analyze this behavior by assuming the same velocity profile for the nonNewtonian lubricants as the Newtonian one, splitting the viscosity into two parts nx and ny, which have relation with x and y directional velocity gradient respectively, and considering side leakage. The results are positive for the nonNewtonian lubricants, which agrees with experiments. The gains are 3 - 10% for most working ranges. Author

N83-15519# Institut National des Sciences Appliquees de Lyon, Villeurbanne (France). Lab. de Mecanique des Contacts.
SLIDING IN THE WORKING OF A ROLLER BEARING: THE INFLUENCE OF THE LUBRICANT [GLISSEMENT DANS LES ROULEMENTS A ROULEAUX INFLUENCE DU LUBRIFIANT] **c37**
Daniel Berthe and Louis Flamand *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 9 p refs In FRENCH Sponsored in part by DRET (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

In rotations of cylindrical rollers, the condition of pure rolling of rolling bodies in relation to the track is only verified when the speeds of rotation are raised and when the loads transmitted are weak. This skidding condition must be limited because it can be the source of important heating and of premature wear. For this reason, the conditions for the mechanical equilibrium of the constitutive elements of a given roller are examined. The kinematics and particularly the speeds of sliding between the rolling bodies and the paths are determined from the normal and tangential actions transmitted by the lubricating films. Consequently, the rheological behavior of the lubricant must be accounted for. Rheology models used for aeronautical lubricants are discussed. The different contacts encountered in the rollers studied are modeled and the total rolling equilibrium is illustrated. A.R.H.

N83-15520*# Missouri Univ., Rolla. Dept. of Mechanical and Aerospace Engineering.
A DETAILED TREATMENT OF TWO-DIMENSIONAL, STARVED LUBRICATION IN THE VICINITY OF TWO COUNTER-ROTATING CYLINDERS **c37**
Robert A. Medrow and Larry R. Shipers *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 10 p (For primary document see N83-15504 06-31)
(Grant NsG-3113)
Avail: NTIS HC A20/MF A01 CSCL 13I

The problem of starved lubrication in the inlet region for the case of line contact between two nondeforming, equal radii cylinders rotating in opposite directions with equal surface speeds is considered. The lubricant is assumed to be a constant density, isoviscous, Newtonian fluid. The usual approach, which involves the use of Reynolds equation everywhere, is not followed. Instead, the situation is restricted to one in which the lubricant enters the contact region in thin films which adhere to the cylinders. Using Reynolds equation only at the line of centers and a suitable thin film approximation far from that point, the intervening region is treated as a general creeping flow region. Solutions, incorporating complete free surface boundary conditions, are obtained numerically. The hitherto unobtained results due to this approach include the existence of a unique free surface location for a fixed set of operating conditions. Author

N83-15521# FAG Kugelfischer Georg Schaefer und Co., Schweinfurt (West Germany).
THE BEHAVIOR OF VARIOUS ROLLING BEARING MATERIALS UNDER UNFAVORABLE LUBRICATION CONDITIONS **c37**
Hans Karl Loroesch, Peter Dreschmann, and Rudolf Weigand *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 9 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

Since the service life of rolling bearings is not only influenced by the material, but also very decisively by the lubrication, the behavior of various rolling bearing materials has been investigated in extensive field - like tests at elevated temperatures and under unfavorable lubrication conditions. These tests revealed that with increasingly unfavorable lubrication conditions the high temperature resistant rolling bearing materials S18-0-1 (AISI T1) and M50 were superior to the conventional rolling bearing material 100Cr6 (SAE 52 100). With pronounced starved lubrication that is caused by lubricating only with the oil vapor produced at a temperature of 215 C (488 K) and still reducing this oil vapor by exhaustion, the following results were found out: the bearings of high temperature resistant rolling bearing materials still reached lives of more than 3% of the rated L10 life, whereas bearings of 100Cr6 (SAE 52 100) steel could not be run any more under these conditions. Both high temperature resistant materials turned out to be comparable under these marked conditions of starved lubrication. The results reveal that rolling bearings of the high temperature resistant steels S18-0-1 (AISI T1) and M50 should not only be used at elevated operating temperatures, as it is the general rule, but also when it is important to obtain a higher operational reliability with starved lubrication conditions. L.F.M.

N83-15522*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GEOMETRY AND STARVATION EFFECTS IN HYDRODYNAMIC LUBRICATION **c37**
David Brewe (AVRADCOM) and Bernard J. Hamrock *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 12 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

Numerical methods were used to detemine the effects of lubricant starvation on the minimum film thickness under conditions of a hydrodynamic point contact. Starvation was effected by varying the fluid inlet level. The Reynolds boundary conditions were applied at the cavitation boundary and zero pressure was stipulated at the meniscus or inlet boundary. A minimum film thickness equation as a function of both the ratio of dimensionless load to dimensionless speed and inlet supply level was determined. By comparing the film generated under the starved inlet condition with the film generated from the fully flooded inlet, an expression for the film reduction factor was obtained. Based on this factor a starvation threshold was defined as well as a critically starved inlet. The changes in the inlet pressure buildup due to changing the available lubricant supply are presented in the form of three dimensional isometric plots and also in the form of contour plots. Author

N83-15523*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LUBRICANT EFFECTS ON EFFICIENCY OF A HELICOPTER TRANSMISSION **c37**
Andrew M. Mitchell and John J. Coy (AVRADCOM) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 14 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01 CSCL 11H

Efficiency tests were conducted using eleven different lubricants in the NASA Lewis Research Center's 500 hp torque regenerative helicopter transmission test stand. The test transmission was the OH58A helicopter main transmission. The mechanical power input to the test transmission was 224 kW (300 hp) at 6060 rpm. Tests were run at oil-in temperatures of 355 K (180 F) and 372 K (210 F). The efficiency was calculated from a heat

balance on the water running through an oil-to-water heat exchanger while the transmission was heavily insulated. The following results were obtained: (1) Among the eleven different lubricants, the efficiency ranged from 98.3 to 98.8 percent, which is a 50 percent variation relative to the losses associated with the maximum efficiency measured; (2) For a given lubricant, the efficiency increased as temperature increased and thus a viscosity decreased. There were two exceptions which could not be explained on the basis of available data; (3) Between lubricants, efficiency was not correlated with viscosity. There were relatively large variations in efficiency with the different lubricants whose viscosity generally fell in the 5 to 7 centistoke range; and (4) The lubricants had no significant effect on the vibration signature of the transmission. Author

N83-15524# Pisa Univ. (Italy). Dipartimento di Costruzioni Meccaniche e Nucleari.
THE DYNAMIC PERFORMANCE OF THE SELF-REGULATED HYDROSTATIC OPPOSED-PAD BEARING c37
R. Bassani and B. Piccigallo (Accademia Navale) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 12 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

The work deals with the behaviour, under dynamic loading, of a special hydrostatic opposed-pad bearing: the 'self-regulated' bearing (capable of dividing the lubricant flow into two equal partial flows in the two recesses as a consequence of its own shape). The bearing is studied in a constant pressure system. The effect of a hydraulic resistance in series with the bearing is also considered. Consequences which may arise from dimensional inaccuracies due to tolerances are also accounted for. Like the static performance, the dynamic performance of the self-regulated bearing is often better than that of conventional bearings; stiffness in particular is much greater. The influence of tolerances may not always be negligible. The design of a standardizing self-regulated bearing is also presented. Author

N83-15525# Poitiers Univ. (France). Lab. de Mecanique des Solides.
DYNAMIC BEHAVIOR OF A SMOOTH BEARING: STABILITY CRITERIA [COMPRTEMENT DYNAMICE D'UN PALIER LISSE CRITERES DE STABILITE] c37
J. Frene, D. Nicolas, and N. Abdul Wahed *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 10 p refs In FRENCH Prepared in cooperation with Institut National Sciences des Appliquees de Lyon, Villeurbanne (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

The dynamic behavior of a bearing depends not only on its geometry, but also on the operating conditions to which it is subjected. It is important to review the domain for which bearing operation is stable, i.e., define the stability criteria. In addition, in the dynamic regime, the response of the bearing must be obtained by calculating the trajector from the center of the shaft to the interior of the pad. The study of the stability of the bearing is approached beginning with the dynamic coefficients calculated using linear theory. The conditions of stability of different types of bearings of fixed geometry are presented in the form of stability charts. The influence of the value of each of these coefficients on the stability of the bearing is examined using the Routh-Hurwitz criteria which shows that Lund's stability criteria leads to identical results while Smith's static stability criteria leads to erroneous results in certain cases. This last point is confirmed in a study of the transitory regime of one particular bearing. Transl. by A.R.H.

N83-15526# Cranfield Inst. of Tech., Bedfordshire (England). School of Mechanical Engineering.
THE COMPUTER AIDED DESIGN ENTITY (CADE): A NEW APPROACH TO JOURNAL BEARING DESIGN c37
A. H. Siew and B. R. Reason *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 12 p refs Sponsored in part UK Sciences Research Council (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

The main features of a newly developed software suite bearing with the steady-state performance of solid and porous journal bearings are outlined. Variable bearing geometry, groove configuration, oil-supply pressure, matrix permeability (for the porous case) and journal misalignment are all within the capabilities of the suite. The suite developed is design-orientated and circumvents many of the existing bearing design problems. It is particularly suitable for: (1) Analysis and performance prediction of the journal bearings' behavior under conventional and newly established boundary conditions. (2) optimization of bearing performance by progressive modification through direct computer/user interaction whilst observing, in real-time, the effect both numerically and graphically on a direct visual display. Good agreement was ound between the results from the use of 'Computer Aided Design Entity' and the experimental findings from various sources. Author

N83-15527# Middle East Technical Univ., Ankara (Turkey). Dept. of Mechanical Engineering.
AN EXPERIMENTAL METHOD FOR THE DETERMINATION OF JOURNAL BEARING COEFFICIENTS c37
M. Akkoek *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 12 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

It is now widely agreed that journal bearing characteristics can be represented by the linearized stiffness and damping coefficients for the purpose of rotor dynamic calculations. The concept of linearized coefficients can only be verified by successful comparison with experimenta data. Feasible methods of experimental determination of the coefficients from the dynamic response are discussed. It is attempted to present an experimental method which makes use of the dependence of the oil film impedances on the excitation frequency. The linearized bearing coefficients are determind with small numerical perturbations about the bearing equilibrium position. The responses to external excitations at synchronous and half-synchronous speeds are calculated. The advantage of low damping at half-synchronous speed makes it possible to get completely different response characteristics. The inverse problem of calculating the bearing coefficients from these responses is solved by assuming practical values of measurement errors in vibration amplitudes. The direct comparison of calculated coefficients and theoretical coefficients over a range of eccentricity ratios shows that this method is adequately accurate for the experimental determination of the coefficients. Author

N83-15528# Technical Univ. of Denmark, Lyngby. Dept. of Machine Elements.
AN ANALYTICAL STUDY OF THE HEAT BALANCE FOR A JOURNAL BEARING c37
P. K. Hansen (Det Norske Veritas) and J. W. Lund *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 9 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

The thermohydrodynamic lubrication problem for a journal bearing was studied. The heat balance for the bearing is emphasized. The flow is assumed to be laminar, the lubricant is Newtonian and incompressible. Allowance is made for the viscosity temperature dependence. The shaft surface temperature is taken to be constant, and at the outer surface of the hearing bush the temperature is determined from heat flux continuity. It is found that: (1) the viscosity temperature dependence has a pronounced influence on the temperature level; (2) heat conduction to the bearing sleeve and the shaft must be taken into account; (3) the temperature variation across the fluid film thickness is significant; (4) the mean temperature in the lubricant is well represented by the parabolic approximation; and (5) under normal operating conditions the axial temperature variation is negligible. E.A.K.

N83-15529# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Technische Physik.
BEHAVIOR OF AIRCRAFT ENGINE OILS AT HIGH TEMPERATURE c37
E. Jantzen *In* AGARD Probl. in Bearings and Lubrication Aug.

1982 11 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

Higher temperatures in current and future aircraft engines which lead to a stronger thermal and oxydative attack of the engine oils were examined. The reversible and irreversible change of the engine oil is reported and the influence of hot surfaces on aircraft engine oils is shown. Different types of deposits, their properties, and the current knowledge about the influencing parameters are reported. Possibilities to avoid deposit formation are shown. E.A.K.

N83-15530*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL AND ANALYTICAL DETERMINATION OF GEAR TOOTH TEMPERATURES WITH OIL JET LUBRICATION c37
Dennis P. Townsend and Lee S. Akin (Western Gear Corp.) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 14 p refs Presented at the ASME 3rd Intern. Power Transmission and Gearing Conf., San Francisco, 18-22 Aug. 1980 (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

Gear tooth average and instantaneous surface temperatures were measured with a fast response infrared radiometric microscope, while operating at arious speeds, loads and oil jet pressures. Increased oil jet pressure had a significant effect on both average and peak surface temperatures at all test conditions, increasing the speed at constant load and increasing the load at constant speed causes a significant rise in average and peak surface temperatures of gear teeth. A gear tooth temperature analysis was conducted by a finite element method combined with a calculated heat input and oil jet impingment depth with estimated heat transfer coefficients based on the experimental data. It is concluded that oil jet pressures required for adequate cooling at high load and speed conditions must be high enough to get full penetration depth of the teeth. E.A.K.

N83-15531# Franklin Research Center, Philadelphia, Pa.
AN ADVANCED METHOD FOR PREDICTING HYBRID BEARING PERFORMANCE c37
R. Colsher, I. Anwar, and S. Katsumata *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 12 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

At computerized technique was developed to predict performance for hydrodynamic, hydrostatic and hybrid bearings operating with an incompressible lubricant. The numerical technique utilizes the finite difference cell approach coupled with Gaussian elimination to solve the lubrication equation (Reynolds equation). The recess pressures are treated as boundary conditions and the lubrication equation is solved in terms of the recess pressures. The recess pressure is determined by coupling the recess flow conditions with the external lubrication supply system. E.A.K.

N83-15532# Universite de Technologie de Compiegne (France). Div. Electromecanique.
THEORETICAL AND EXPERIMENTAL STUDY OF AN AXIAL MAGNETIC BEARING OF THE ACTIVE TYPE [ETUDE THEORIQUE ET EXPERIMENTALE D'UN PALIER MAGNETIQUE AXIAL DU TYPE ACTIF] c37
Michel Kant and Roger Kessou *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 6 p refs In FRENCH (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

The active axial magnetic bearing which serves vertical or horizontal supports is discussed. The bearing is used on the principles of ferrogravitaion. The originating electromagnetic force is proportionally inverted in the square distance, which separates the two parts; the bearing's dynamic functions for the constant electromagnetic force are unstable. To stabilize the bearing the present inductor has to be brought under control to a balanced deposition. The bearing is modelled by finite element method which allows calculation of the supporting forces, and to identify a chain of optimal control. E.A.K.

N83-15533# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Dept. Chemin.
THE ACTIDYNE ACTIVE MAGNETIC BEARING [LE PALIER MAGNETIQUE ACTIF ACTIDYNE] c37
Helmut Habermann *In its* Probl. in Bearings and Lubrication Aug. 1982 9 p refs In FRENCH (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

The active magnetic bearing which is based on the utilization of a force developed by a magnetic field, to maintain a rotor by magnetic lifting without mechanical contact between the fixed and the moving parts is discussed. It is necessary to have two electromagnets which only work by gravitation to control a degree of freedom. Controls obtained by application of tension makes fast separation unnecessary. E.A.K.

N83-15534# Sussex Univ., Brighton (England).
AN INVESTIGATION OF SQUEEZE-FILM DAMPERS IN FLEXIBLE SUPPORT STRUCTURES c37
R. Holmes and M. Dogan *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 9 p refs Sponsored in part by Rolls Royce (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

Rig investigations in which structural flexibility is included experimentally is discussed and measured and predicted vibration results are compared. Squeeze film dampers are a means of reducing vibration amplitudes in rotating shaft assemblies. Their efficiency depends very much on the condition of the oil, which in turn depends on inlet and outlet arrangements, on daper geometry and on the flexibility of the rotor and surrounding structure. E.A.K.

N83-15535# CEMUL, Lisbon (Portugal).
SQUEEZE-FILM BEARING SUPPORT ANALYSIS c37
F. A. P. DaSilva *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 8 p refs Sponsored in part by UK Sciences Research Council (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

The effect of the nonuniformity on the performance of the squeeze film was investigated. Squeeze film bearings operate on high frequency vibration of one the bearing surfaces. The time averaged pressurization effect is mainly due to the compressibility of the gas film and this degree of pressurization depends on the amplitude and frequency of oscillation of the moving surface. If this supporting surface is sufficiently flexible, the amplitude of vibration is not uniform. The characteristics of the supporting member are demonstrated to be critical as they dictated the frequency of operation at low input power. Cases considered respect discs and conical shapes. For discs a particular parameter, the ratio between the inner and the outer edges, is analyzed. E.A.K.

N83-15536# Cranfield Inst. of Tech., Bedfordshire (England). School of Mechanical Engineering.
UNCENTRALIZED SQUEEZE-FILM DAMPER BEARINGS APPLIED TO AN OVERHUNG DISC/ROTOR SYSTEM c37
R. A. Cookson and Xin-Hai Feng (Chinese Aeronautical Establishment) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 13 p refs Sponsored in part by UK Sciences and Engineering Research Council (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

A shaft disc system which is closer to a practical gas turbine is considered. This model includes a disc (turbine) supported noncentrally between two squeeze-film damper bearings, and an overhung disc. It is indicated that the forces transmitted into the support structure can be drastically reduced if a correct combination of damper parameters is chosen. Also, this investigation would appear to indicate that the design of squeeze film damper is almost always more efficient, and never less efficient, than the squirrel caged design. E.A.K.

N83-15537# Karlsruhe Univ. (West Germany). Inst. fuer Maschinenkonstruktionslehre.
AERODYNAMIC COMPLIANT BEARINGS FOR SMALL TURBOENGINES c37

M. Ehinger, J. Glienicke, and H. Hunger *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 13 p refs Sponsored in part by Bundesministerium fuer Wirtschaft (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

Aerodynamic spring bearings, the elastic bearing bushing structure of which can stand thermal deformations without any inadmissably large changes in the bearing clearance were investigated. The spring bearings be suitable for the mounting of small turbo machines under extreme operating conditions. A method to determine the static and dynamic spring bearing characteristic curves was developed and applied to the tilting pad, 'Garrett' and multiwedged spring bearing. In the static and dynamic bearing characteristic curves determined in this way the parameters of the resilient bearing bushing structure are dominant over wide ranges. The applicability of these hearings to extreme circumferential speeds. The reliability of the calculated bearing characteristic values is shown. E.A.K.

N83-15538# Garrett Turbine Engine Co., Phoenix, Ariz.
HIGH-TEMPERATURE (649 DEG C/1200 DEG F) COATINGS FOR GAS-LUBRICATED FOIL BEARINGS OF THE NAVY'S ADVANCED AUXILIARY POWER UNIT CONCEPTS c37
Frank J. Suriano, Robert J. Keiser, Fred G. Woessner (Naval Air Propulsion Center, Trenton), and Ray Valori (Naval Air Propulsion Center, Trenton) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 17 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

The materials development task and the identified coatings for high temperatures are described. In a high temperature foil bearing development effort a separate materials task was directed at identifying and developing coatings and coatings combinations for use in a turbine end journal foil bearing of an advanced design auxiliary power unit. The coatings are required to operate in thermal environments up to 649 C. E.A.K.

N83-15539# Middle East Technical Univ., Ankara (Turkey). Dept. of Mechanical Engineering.
EVALUATION OF ANTI STICK-SLIP BEHAVIOUR OF BRONZE FILLED PTFE AS BEARING MATERIAL c37
O. Anlagan *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 7 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

The performance of bronze filled PTFE at slow speeds was evaluated. The mechanism involved in wear which is primarily responsible for the loss of slow speed performance is explained. The behavior change is attributed to the mechanical changes that takes peace on sliding surface of plastic as wear progresses, which leads to change of friction velocity profile from positive to negative. E.A.K.

N83-15540# Pisa Univ. (Italy). Ist. di Macchine.
APPLICATION OF DYNAMIC GAS BEARINGS TO CRYOGENIC COMPRESSORS AND TURBINES c37
G. Nardi *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 7 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

A design of dynamic gas bearing containing tilting pads, for cryogenic compressor and turbine applications, is discussed. The bearing system has no gas input during normal operation to prevent entirely the exchange of hot and cold gas. A pressure increase is generated in the wedge shaped gas film between the shaft and the pad. A portion of the gas stream flowing through the wedge is introduced through the pad into the gas between the pad and the pad housing. In this manner, the pressure in the gap is a factor of the pressure in the wedge. The pad is completely surrounded by a gas film. It adjusts itself automatically in accordance with the equilibrium of the forces. The angle of incidence of the pads is determined by the equilibrium of torques relative to the axis of rotation of the pad. It is shown that the gas bearing offer the advantage of improved reliability because no control system is necessary. E.A.K.

N83-15541# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.
DEVELOPMENT OF ENGINEERING CODES OF PRACTICE FOR CORROSION FATIGUE
P. M. Scott, B. Tomkins, and A. J. E. Foreman Apr. 1982 30 p refs
(AERE-R-10480) Avail: NTIS HC A03/MF A01

The recognition that time dependent effects of aqueous corrosion can have a large influence on fatigue failure in structural steels for nuclear reactor pressure vessels is having an important influence on the continuing process of revision and improvement of design and inspection codes. The contrasting requirements of engineering codes for design purposes or for in-service inspection purposes are discussed. The critical assumptions in each are highlighted and illustrated with examples incorporating recent improvements in the mechanistic understanding of the development of corrosion fatigue failure. The consequences of adopting a crack tolerant approach in the design phase, as distinct from the evaluation of defects found in-service, are also critically examined. Author

N83-15259# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A NEW COMPLEX ELECTROHYDRAULIC SERVOSYSTEM
You Jinlu (China Precision Engineering Inst. for Aircraft Industry) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 161-180 Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

N83-15735# Foraky Ltd. (England).
CONSTRUCTION OF TWO SHORT TUNNELS USING ARTIFICIAL GROUND FREEZING
John S. Harris and E. Hugh Norie (Mott, Hay and Anderson, Consultants, England) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 383-388 (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 13/2

N83-15736# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
A CASE HISTORY OF A TUNNEL CONSTRUCTED BY GROUND FREEZING
Hugh S. Lacy (Freezewall, Inc.), John S. Jones, Jr. (Law Engineering Testing Co., Washington, D.C.), and Brien Gidlow (OBrien and Gere Engineers, Inc., Syracuse, N.Y.) *In its* Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 389-396 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 13/2

N83-15738# Linde A.G., Munich (West Germany). Industrial Gases Div.
NEW FREEZE PIPE SYSTEMS FOR NITROGEN FREEZING
Dieter Rephan *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 429-435 (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 13/2

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N83-15542* Research Triangle Inst., Research Triangle Park, N.C.
RESEARCH IN THE AREA OF HIGH-SPEED ON-BOARD SATEL-

LITE SIGNAL PROCESSING. TASK 1: LAS DEMONSTRATION HARDWARE TRANSITION TO FLIGHT QUALIFICATIONS Final Report, 24 Sept. 1981 - 30 Jul. 1982

J. V. Aanstoos, W. H. Ruedger, and W. E. Snyder Dec. 1982 86 p refs

(Contract NAS1-16777)

(NASA-CR-165993; NAS 1.26:165993) Avail: Issuing Activity CSCL 17B

The Information Adaptive System (IAS) under development which is intended to provide a space borne computational capability to off load the ground based computational bottleneck is discussed. This system comprises a major component of the end to end data system concept. The LAS provides the capability to produce multispectral images onboard which are corrected and registered to Earth based map coordinates. The potential use of technology which is developed for Very High Speed Integrated Circuits (VHSIC) program is addressed. This program and the circuits under developement in its first phase are discussed. E.A.K.

N83-15543*# Motorola, Inc., Scottsdale, Ariz. Government Electronics Group.

SATELLITE SWITCHED FDMA ADVANCED COMMUNICATION TECHNOLOGY SATELLITE PROGRAM Final Report, Nov. 1981 - Dec. 1982

S. Atwood, G. H. Higton, K. Wood, A. Kline, A. Furiga, M. Rausch, and Y. Jan Dec. 1982 308 p

(Contract NAS3-22895)

(NASA-CR-168034; NAS 1.26:168034; PJ050) Avail: NTIS HC A14/MF A01 CSCL 17B

The satellite switched frequency division multiple access system provided a detailed system architecture that supports a point to point communication system for long haul voice, video and data traffic between small Earth terminals at Ka band frequencies at 30/20 GHz. A detailed system design is presented for the space segment, small terminal/trunking segment at network control segment for domestic traffic model A or B, each totaling 3.8 Gb/s of small terminal traffic and 6.2 Gb/s trunk traffic. The small terminal traffic (3.8 Gb/s) is emphasized, for the satellite router portion of the system design, which is a composite of thousands of Earth stations with digital traffic ranging from a single 32 Kb/s CVSD voice channel to thousands of channels containing voice, video and data with a data rate as high as 33 Mb/s. The system design concept presented, effectively optimizes a unique frequency and channelization plan for both traffic models A and B with minimum reorganization of the satellite payload transponder subsystem hardware design. The unique zoning concept allows multiple beam antennas while maximizing multiple carrier frequency reuse. Detailed hardware design estimates for an FDMA router (part of the satellite transponder subsystem) indicate a weight and dc power budget of 353 lbs, 195 watts for traffic model A and 498 lbs, 244 watts for traffic model B. S.L.

N83-15544# Army Missile Command, Redstone Arsenal, Ala. Advanced Sensors Directorate.

A SURVEY OF ANALOG-TO-DIGITAL CONVERTER TECHNOLOGY FOR RADAR APPLICATIONS

Billy E. Jones 29 Mar. 1982 21 p

(AD-A119966; AD-E950298; DRSMI/RE-82-8-TR) Avail: NTIS HC A02/MF A01 CSCL 09/5

The first section of this report discusses sample and hold devices (SHD) which are required prior to the analog to digital converter (ADC) in most radar applications. The SHDs discussed had acquisition times of 10 microsecs or less. plots of SHD droop rate and aperture uncertainty versus acquisition time are presented. The next section contains details on a variety of commercial off the shelf ADCs that have sampling rates greater than 100 KHz. They are compared by resolution, sampling rate, packaging, logic family, size, cost, power requirements, and temperature stability. Finally, brief descriptions of ADCs in development are discussed, and a resolution versus sampling rate comparison of noncommercial ADCs being manufactured by radar houses and their suppliers is presented. The performance envelopes of the commercial and noncommercial ADCs are then overlayed on the estimated 1988 Radar and ELINT resolution and sampling rate requirements. Author (GRA)

N83-15545*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

DETAILED OBSERVATIONS OF THE SOURCE OF TERRESTRIAL NARROWBAND ELECTROMAGNETIC RADIATION Progress Report

W. S. Kurth 27 Aug. 1982 26 p refs Submitted for publication

(Contract NAS5-26819; Grant NGL-16-001-043; Contract N00014-76-C-0016)

(NASA-CR-169644; NAS 1.26:169644; AD-A119967; U-OF-IOWA-82-19) Avail: NTIS HC A03/MF A01 CSCL 20/14

We present detailed observations of a region near the terrestrial plasmapause where narrowband electromagnetic radiation (previously called escaping nonthermal continuum radiation) is being generated. These observations show a direct correspondence between the narrowband radio emissions and electron cyclotron harmonic waves near the upper hybrid resonance frequency. In addition, electromagnetic radiation propagating in the Z-mode is observed in the source region which provides an extremely accurate determination of the electron plasma frequency and, hence, density profile of the source region. The data strongly suggest the electrostatic waves and not Cerenkov radiation are the source of the banded radio emissions and clearly define the coupling mechanism which must be described by any viable theory. GRA

N83-15546# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.

VISIBLE AND INFRARED TRANSMISSION THROUGH SNOW Final Report

Mary Ann Seagraves and John F. Ebersol (OptiMetrics, Inc.) Aug. 1982 35 p refs

(DA Proj. 1L1-61102-B-53A)

(AD-A119983; ERADCOM/ASL-TR-0119) Avail: NTIS HC A03/MF A01 CSCL 20/14

Visible and infrared extinction in falling snown is a function of snow particle concentration and snow crystal size and shape. Relationships between existing meteorological conditions and these characteristics have been investigated using measurements made during the SNOW-ONE field experiment. Effects of meteorological conditions upon extinction are discussed and empirical models are suggested. Causes of the variation of extinction with wavelength in the visible and infrared are identified and the magnitudes of some of the possible effects are estimated. GRA

N83-15547# Haskins Labs., New Haven, Conn.

SPEECH RESEARCH: STUDIES ON THE NATURE OF SPEECH, INSTRUMENTATION FOR ITS INVESTIGATION, AND PRACTICAL APPLICATIONS Status Interim Scientific Report, 1 Jan. - 31 Mar. 1982

Alvin M. Liberman Mar. 1982 302 p refs

(Contracts PHS-HD-01994; PHS-HD-16591; Grants PHS-N01-HD-1-2420; PHS-RR-05596; PHS-NS13870; PHS-NS13617; PHS-NS18010; NSF PRF-80-06144; NSF BNS-81-11470)

(AD-A120819; SR-69(1982)) Avail: NTIS HC A14/MF A01 CSCL 06/16

This report is one of a regular series on the status and progress of studies on the nature of speech, instrumentation for its investigation and practical applications. Manuscripts cover the following topics: Speech perception and memory coding in relation to reading ability; The use of orthographic structure by deaf adults: Recognition of finger-spelled letters; Exploring the information support for speech; The stream of speech; Using the acoustic signal to make inferences about place and duration of tongue-palate contact. Patterns of human interlimb cooridination emerge from the the properties of nonlinear limit cycle oscillatory processes: Theory and data; Motor control: Which themes do we orchestrate? Exploring the nature of motor control in Down's syndrome; Periodicity and auditory memory: A pilot study; Reading skill and language skill: On the role of sign order and morphological structure

in memory for American Sign Language sentences; Perception of nasal consonants with special reference to Catalan; and Speech production Characteristics of the hearing impaired. GRA

N83-15548# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEVELOPMENT OF REMOTE DATA TRANSMISSION SYSTEMS
Elzbieta Siwak-Szczepek 22 Sep. 1982 14 p refs Transl. into ENGLISH from Wiad. Telekomunikacyjne (Poland), v. 18, no. 10, Oct. 1979 p 281-286
(AD-A120729; FTD-ID(RS)T-1042-82) Avail: NTIS HC A02/MF A01 CSCL 17/2

The design of computerized information and remote transmission systems based on the Mera-300 series minicomputer equipment manufactured in Poland is discussed with emphasis on the design of subsystems and software for operating as part of the basic telex computerized information system which utilizes the existing country-wide telegraph network. This multiplexed telegraphy system uses a computer, a minicomputer, and a teleprinter, telephone, or television set as a terminal. Data transmitted is edited in accordance with user requirements and is prepared from the standpoint of format and content by the computer. A.R.H.

N83-15549# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TELECOMMUNICATION STATION CABLES WITH SCREENED PAIRS
Tadeusz Lapinski 20 Sep. 1982 9 p Transl. into ENGLISH from Wiad. Telekomunikacyjne (Poland), v. 20, no. 12, Dec. 1980 p 345-346
(AD-A120727; FTD-ID(RS)T-1044-82) Avail: NTIS HC A02/MF A01 CSCL 09/1

Telecommunication station cables with insulation and polyvinyl coating with screened pairs are intended for telecommunication station to station connections in multiple system equipment for frequencies greater than acoustic frequencies. These cables make possible the correct operation of equipment in rooms at temperatures varying from -10 to +50 C in cases where mechanical hazards occur in the form of bending or vibrations and from -40 to +70 C in cases where mechanical hazards do not occur. These cables can be laid at a temperature varying from 0 to 40 C. The cable factory is manufacturing cables with screened pairs designated by the symbol YTKSYekp in accordance with WT-79/K-121 technical specifications with the number of pairs: 2-6-7-10-12 and 21. The cable strands are made from soft copper wire (either nonzinc-coated or zinc-coated) with a 0.5 mm nominal diameter. These strands ensure that solid and covered joints can be made. The latter must be zinc-coated and have a rupture elongation in the range of 15% to 30%. GRA

N83-15550# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BIST SYSTEM AND ITS USE IN GOVERNMENT
Czeslaw Syc 22 Sep. 1982 12 p Transl. into ENGLISH from Wiad. Telekomunikacyjne (Poland) v. 18, no. 3, Mar. 1979 p 65-68
(AD-A120726; FTD-ID(RS)T-1040-82) Avail: NTIS HC A02/MF A01 CSCL 17/2

The effectiveness of the telecommunications networks and existing means of information transfer, that is in the realm of teleinformation are analyzed. The improvement of information processing in the management of such economic areas as: transportation, communication, commerce and supply, the management of materials, energetics and agriculture is emphasized. These areas have gained highest priority in the framework of economic management. The structure of requirements of communication in these sectors of national economy is not much different from requirements for other sectors and includes 70 to 90% of free network transmission, that is, 50 to 200 Bd. These requirements may be satisfied within 50 Bd. by the telex network which is now a digital and completely automated system for domestic purposes. For 200 Bd. additional network may be leased. Most users of the teleinformation system are interested in transmission among subscribers often scattered nationwide. GRA

N83-15551# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MODEM 2400
Barbara Kierkowska 15 Sep. 1982 17 p Transl. into ENGLISH from Wiad. Telekomunikacyjne (Poland), v. 17, no. 7/8, Jul.-Aug. 1977
(AD-A119868; FTD-ID(RS)T-1037-82) Avail: NTIS HC A02/MF A01 CSCL 17/2

Data transmission by telecommunication on remote data transmission lines is discussed. The modem 2400 which is used in remote data processing systems is presented. E.A.K.

N83-15552# National Telecommunications and Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
NONDIRECTIONAL BEACONS: COVERAGE LIMITATIONS DUE TO NIGHT EFFECT Final Report
L. A. Berry and M. E. Johnson Washington FAA Jul. 1982 27 p refs
(AD-A120155; DOT/FAA/RD-82/44) Avail: NTIS HC A03/MF A01 CSCL 17/2

Annex 10 of International Standards and Recommended Practices Aeronautical Telecommunications contains tables of the distances at which the groundwave and skywave from a nondirectional beacon (NDB) are equal and the distances at which the groundwave exceeds the skywave by 10 dB. These tables were probably based upon the experience of users. In this report the modeling assumptions necessary to duplicate the tables using modern computer prediction methods are determined. A table of distances at which the groundwave exceeds the skywave by 10 dB is computed for frequencies from 190 kHz to 1000 kHz and for ground conductivities from 5 mho/m to 0.00025 mho/m.
Author (GRA)

N83-15553# Naval Research Lab., Washington, D. C.
WIDEBAND HF CHANNEL PROBER TIMING AND CONTROL MODULES Memorandum Report, Jun. 1978 - Jul. 1982
L. S. Wagner and J. A. Goldstein 29 Sep. 1982 37 p refs
(AD-A120131; NRL-MR-4933) Avail: NTIS HC A03/MF A01 CSCL 17/2

The timing and control functions for the Wideband HF Channel Prober system have been implemented utilizing digital logic circuits and a microprocessor in a hybrid hardware - software design. The system's speed and flexibility requirement dictated which functions could and should be implemented in a microprocessor. Functions that required higher speed and less flexibility were implemented using TTL logic circuits. This report discusses the design criteria and the logic hardware and microprocessor software for implementing the design requirements of the timing and control functions of the Wideband HF Channel Prober apparatus. GRA

N83-15554# Ohio State Univ., Columbus ElectroScience Lab.
A FOUR-PHASE MODULATION SYSTEM FOR USE WITH AN ADAPTIVE ARRAY Interim Report
Jack H. Winters Griffiss AFB, N.Y. RADC Jul. 1982 243 p refs
(Contract F30602-79-C-0068; AF Proj. 4519)
(AD-A120673; ESL-711679-5; RADC-TR-82-108) Avail: NTIS HC A11/MF A01 CSCL 20/14

This report discusses the use of four-phase modulation in a communication system with an adaptive array. A system is described that provides protection against both conventional (i.e., noise and CW) and smart (in particular, repeat) jamming with rapid acquisition of the signal at the receiver. This report first discusses four-phase modulation techniques and how they can be used with an adaptive array. Reference signal generation for the LMS adaptive array is discussed for these modulation techniques. A communication system is then described that uses one of these modulation techniques. The four-phase signal consists of two orthogonal biphase signals. One signal contains a short code for

rapid acquisition. The other contains a long code for protection against smart jammers. A several step signal acquisition technique is also described for the system. The short code timing is first acquired by a sliding correlation method. With the short code used in reference signal generation, the long code timing is rapidly acquired by the Rapid Acquisition by Sequential Estimation method. The long code is then used in reference signal generation. GRA

N83-15555# Princeton Univ., N. J. Lab. of Information Sciences and Systems.
DETECTION IN A NON-GAUSSIAN ENVIRONMENT Technical Progress Report, Mar. 1981 - Jun. 1982
Stuart C. Schwartz and John B. Thomas Sep. 1982 24 p refs Presented at the Signal Processing in the Ocean Environment, Annapolis, Md., 11-14 May 1982
(Contract N00014-81-K-0146)
(AD-A120721; TR-5) Avail: NTIS HC A02/MF A01 CSCL 17/2

Techniques for the detection of a weak signal in non-Gaussian, ill-defined noise are considered. Statistical characterizations used are moments, tail measures related to quantiles, and a measure related to the score function. For multivariate densities, the characterization is by means of a nonlinear transformation. Initial results seem to indicate that assuming a particular family of probability densities does not necessarily result in a significant degradation in performance when the observations actually come from a density outside the assumed family. More important to performance are accurate estimates of the moments, tail measures, or other parameters which are used to specify the detector.
Author (GRA)

N83-15556# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MODE S INSTALLATION AND SITING CRITERIA
Ronald G. Sandholm 13 Sep. 1982 33 p refs
(Contracts F19628-80-C-0002; DOT-FA72WAI-261; FAA Proj. 032-241-04)
(AD-A120650; ATC-99-Rev-A; FAA-RD-82-58) Avail: NTIS HC A03/MF A01 CSCL 17/9

This paper provides information on site-associated phenomena that affect the proper operation of a Mode S sensor and therefore warrant serious consideration when siting a sensor. The Mode S related discussion is intended to be a supplement to the ATCRBS siting criteria presented in the FAA Primary/Secondary Terminal Radar Siting Handbook. The paper discusses siting criteria as they relate to the Mode S sensor antenna system, as opposed to the ATCRBS hogtrough antenna, and importantly, addresses those characteristics of the surrounding environment that are crucial to proper Mode S surveillance. GRA

N83-15557# Rome Air Development Center, Griffiss AFB, N.Y.
EXACT SOLUTION FOR THE ELECTROMAGNETIC FIELDS OF A UNIFORM LINE-CURRENT PARALLEL TO A FLAT HOMOGENEOUS EARTH
Edward A. Lewis and John L. Heckscher Apr. 1982 27 p refs (AF Proj. 4600)
(AD-A119962; RADC-TR-82-92) Avail: NTIS HC A03/MF A01 CSCL 20/3

A detailed step-by-step description is given of the exact solution of the boundary-value problem of calculating the fields of a uniform, sinusoidally varying, straight-line current flowing at a fixed height above a flat homogeneous earth of arbitrary dielectric constant and conductivity. The solution satisfies Maxwell's equations and boundary conditions, reduces to Ampere's Law at the current itself, and hence includes the radiation fields. The results contain integrals with infinite limits, but these can be evaluated numerically in specific cases of interest. As an example, the resistivity induced in a wire 10 m above the earth of 1/1000 mho/m conductivity is calculated for a frequency of 35 kHz. Author

N83-15558# Lowell Univ., Mass. Center for Atmospheric Research.
MEASURING THE ANTENNA PATTERN OF THE HF HEATER ANTENNA IN PUERTO RICO
Bodo W. Reinisch, Robert W. Gowell, James G. Moore, Jackie B. Waaramaa, and Robert R. Gamache Hanscom AFB, Mass. AFGL Mar. 1982 43 p ref
(Contract F19628-80-C-0064; AF Proj. 4643)
(AD-A119963; ULRF-419/CAR; SR-3; AFGL-TR-82-0123) Avail: NTIS HC A03/MF A01 CSCL 09/5

The radiation pattern of the 4 x 8 element array of the Arecibo HF heater antenna was measured with a Digisonde onboard AFGL's KC 135 airplane. With seven flight tracks over the antenna array at an altitude of 8840 m it was verified that the radiation pattern of the heater antenna is in good agreement with the calculations. The measurements were conducted at 5.1 MHz. Author (GRA)

N83-15559# Army Missile Command, Redstone Arsenal, Ala. Research Directorate.
MEDIAN FILTERING OF SPECKLE NOISE
N. C. Gallagher, D. W. Sweeney, and C. R. Christensen 8 Feb. 1982 23 p refs
(AD-A119964; AD-E950297; DRSMI/RR-82-6-TR) Avail: NTIS HC A02/MF A01 CSCL 09/1

A digital model was developed which simulates the physical process of speckle noise generation in coherent imagery. This was used to determine the effectiveness of two-dimensional digital filters for the reduction of speckle noise. Median filters, ranked order filters, and separable combinations of these were evaluated and found to yield good improvement in image signal-to-noise ratios. Author (GRA)

N83-15560# Rome Air Development Center, Griffiss AFB, N.Y.
ERROR SOURCES IN MEASUREMENTS OF LARGE-APERTURE SPACE-BASED RADAR ANTENNAS
Randy L. Haupt and Michael J. OBrien May 1982 23 p
(AF Proj. 4600)
(AD-A119922; RADC-TR-82-118) Avail: NTIS HC A02/MF A01 CSCL 17/9

The sources of errors associated with measuring the radiation pattern of space-deployable radar antenna are examined. The specifications for the Space-Based Radar require a lightweight, fragile antenna with a large aperture and low sidelobes. These three requirements place severe constraints on both the testing environment and the measurement equipment. Applicable sources of errors were presented for both farfield and nearfield measurement techniques. Author (GRA)

N83-15561# Contel Information Systems, Vienna, Va.
COMMUNICATIONS PROTOCOL STRUCTURE Final Report
23 Sep. 1982 155 p refs
(Contract N00014-81-C-2477)
(AD-A120771; AD-E001358; FR-343.01) Avail: NTIS HC A08/MF A01 CSCL 17/2

This report is composed of three volumes. The first volume outlines the requirements and protocol structure for the Naval Telecommunications System (NTS). The second volume outlines the requirements and the specifications of the high frequency (HF) ship shore protocol. The third volume examines the issues related with the integration of voice/data. The applicability of the Open Systems Interconnection (OSI) protocol architecture developed by the International Standards Organization has been studied for potential use in future Naval Telecommunications Systems. GRA

N83-15562# San Diego State Univ., Calif. Dept. of Mathematical Sciences.
SIGNAL DETECTION FOR UNIFORM RENEWAL PROCESSES
Y. Choi, C. B. Bell, R. Ahmad, and C. J. Park Jun. 1983 61 p refs
(Contract N00014-80-C-0208)
(AD-A120785; I-82) Avail: NTIS HC A04/MF A01 CSCL 17/2

Detection problems for renewal processes are represented in the formats of GOF(goodness-of-fit), 2 sample; and GOF with nuisance parameter problems. The techniques are all based on the minimal sufficient statistic or its orthogonal complement. The statistics employed are, for the most part, that of Kolmogoroy, and its modification by Lilliefors and Srinivasan. Each technique is illustrated by a numerical example. GRA

N83-15563# Network Analysis Corp., Vienna, Va.
DATA COMMUNICATIONS SUPPORT FOR THE ATC COMPUTER REPLACEMENT PROGRAM (1988-1996) Final Report
Nov. 1981 202 p refs
(Contract DOT-FA7WA-4335)
(AD-A120784; NAC/FR-303H-01; FAA-RD-81-104) Avail: NTIS HC A10/MF A01 CSCL 17/2

This study provides a look-ahead to the data communications capabilities needed during the FAA's Enroute Computer Replacement Program (CRP). The support of normal ATC functions and the planned Advanced EnRoute Automation (AERA) functions are considered in addition to the computer replacement requirements themselves. A mixture of packet-switched and dedicated networks utilizing both terrestrial and satellite facilites was found to be the most attractive approach to provide such support. The terrestrial packet-switched network should be highly interconnected with switches in each center and should provide virtual circuit and alternate routing capabilities between all centers. Concentration or multiplexing should also be considered at major air terminals. Results of this task also provide feedback on the data communications impact of the concepts related to Center Backup and Terminal Consolidation. Author (GRA)

N83-15564# Johns Hopkins Univ., Baltimore, Md. Dept. of Electrical Engineering and Computer Science.
PARALLEL ALGORITHMS AND COMPUTATIONAL STRUCTURES FOR LINEAR ESTIMATION PROBLEMS
Gerard G. L. Meyer and Howard L. Weinert Sep. 1982 20 p refs
(Contract N00014-81-K-0813)
(AD-A120831; JHU-82-8) Avail: NTIS HC A02/MF A01 CSCL 17/2

Modern acquisition techniques produce high volume data sets that must be processed not only very quickly, but also reliably. The only realistic means for achieving high throughput is the use of parallelism. In terms of reliability, we need the capability of efficient and timely fault detection, location recovery and repair. In this paper, we consider computational structures for a specific type of signal processing-linear estimation problems-that incorporate both parallelism and fault detection and location features. The first part of the paper is devoted to a discussion of real time fault detection requirements. Then the following section considers fault detection and parallel processing of statistical signals using the concept of stochastic redundancy. Finally, parallel algorithms and reliable network designs are presented for a linear regression problem. Author (GRA)

N83-15565# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONCEPT UTILIZING TELEX NETWORK FOR OPERATIONAL MANAGEMENT REQUIREMENTS
Edward Kowalczyk 15 Sep. 1982 17 p Transl. into ENGLISH of Wiadomosci Telekomunikacyjne (Poland), v. 17, no. 1, Jan. 1978 p 1-4
(AD-A119867; FTD-ID(RS)T-1038-82) Avail: NTIS HC A02/MF A01 CSCL 17/2

The simplest and least expensive means ensuring fast transmission of documented (recorded) information on a country-wide scale for all kinds of users is the telex network, which is fully automated in Poland at this time (except for foreign message traffic) with more than 17,000 subscribers. As a digital network, the telex network constitutes, in principle, a base network that is ready for use to transmit information as part of remote data transmission systems. A.R.H.

N83-15566# B-K Dynamics, Inc., Rockville, Md.
ENVIRONMENTAL ATTENUATION OF AIRBORNE RADAR
Bruce J. Spaulding, Ira F. Kuhn, Jr., and George N. Baum 8 Mar. 1982 51 p refs
(Contract MDA903-81-C-0313; ARPA Order 4267)
(AD-A119883; TR-3-513) Avail: NTIS HC A04/MF A01 CSCL 17/9

The most stressing weather scenario for a long range airborne radar is looking to the limb of the earth, and beyond, in an extensive precipitating stratiform system. This is due to both the long horizontal path lengths which must transverse the longest dimensions of stratiform clouds and the shortest dimensions of the less frequently occurring thunderstorms. Realistic vertical profiles of cloud density, effective rainfall rate, and temperature were developd for a typical extensive system. Cloud and rainfall attenuations were then calculated for each 1000 foot layer of the system for each of the two seasons (fall-spring and winter) over the microwave radar frequencies (L-Band through X-Band). Total two way path attenuations were then determined for each of three ranges to 200 feet from a 65,000 foot platform; 300 nm, 250 nm, and 200 nm. The total two way results are given. Also examined are frequently used values of cloud density and discrepancies between theoretical and empirical values for rainfall attenuation coefficients. GRA

N83-15567# Naval Research Lab., Washington, D. C.
ON THE ACCURACY OF A NUMERICAL INTEGRATION PROCEDURE FOR COMPUTING DIFFRACTION FIELDS USING TABLE-LOOK-UP Interim Report
James K. Hsiao 16 Sep. 1982 10 p refs
(AD-A120564; NRL-8628) Avail: NTIS HC A02/MF A01 CSCL 20/14

In this report we have analyzed the errors introduced by table-look-up when an electromagnetic diffraction integral is performed numerically. We have shown that, in order to keep the error of both the real and imaginary components to be less than epsilon, the required table should have at least K entries uniformily distributed within a 2 pi range K > or = 3.85/epsilon square root of N and N is the number of terms used for numerical integration. A numerical example is presented that confirms this prediction. Author (GRA)

N83-15568# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
AN AUTOMATED DUAL HORN-REFLECTOR MICROWAVE ABSORBER MEASUREMENT SYSTEM, VOLUME 1 Interim Report, 15 Jun - 15 Sep. 1981
Brian Kent Jun. 1982 89 p refs
(AF Proj. 7633)
(AD-A120577; AFWAL-TR-81-1284-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 14/2

In recent years, extreme interest has been shown in materials which absorb electromagnetic energy in the microwave and millimeter frequency bands. One of the primary methods of evaluating Radar Absorbing Materials (RAM) is to obtain the electrical and magnetic constants of permittivity (epsilon) and permeability (mu) of the material from which the RAM is constructed. Usually, the (mu, epsilon) of a typical microwave absorber varies strongly as a function of frequency. Hence, in order to evaluate the performance of a wide band microwave absorber, it would de desirable to design and build a system which measures (mu, espilon) across a wide frequency band. The Dual Horn-Reflector Microwave Absorber Measurement System discussed herein obtains the (mu, epsilon) of a homogeneous rectangular sample of material from 12.6 - 18.0 Gigahertz by measuring the scattering parameters S11(omega) and S21(omega) from the sample directly in the Frequency Domain. The overall accuracy of this measurement system is five to ten percent. GRA

N83-15569# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Mathematics.
NONLINEAR WAVES Final Technical Report
Mark J. Ablowitz, D. J. Kaup, and A. C. Newell 23 Sep. 1982 602 p refs
(Contract N00014-76-C-0867)
(AD-A119843) Avail: NTIS HC A99/MF A01 CSCL 12/1

The areas of study during the period of this grant include: A class of physically significant singular nonlinear integro-differential equations; the Riemann-Hilbert boundary value problem and the Inverse Scattering Transform method; Direct linearizing methods for certain nonlinear wave equations and associated nonlinear

ordinary differential equations; Focusing instabilities and the propagation of water waves; Ordinary differential equations of Painelve type; and numerical schemes for nonlinear wave equations solvable by the Inverse Scattering Transform method. Research has also been carried out into the following nonlinear systems: Stimulated Raman Scattering and two-photon absorption; Nonlinear resonances and spherical solutions; Nonlinear interactions of Whistler Waves; Exact three-dimensional solutions of the three-wave resonant interaction, Discrete versions of the nonlinear Schrodinger Equation; and Thermal effects on solution propagation. GRA

N83-15570# Ohio State Univ., Columbus. Electroscience Lab.
AN ALGORITHM TO SELECT ELEMENT LOCATIONS OF AN ADAPTIVE ARRAY Interim Report, Sep. 1980 - Sep. 1981
Inder J. Gupta and W. D. Burnside Griffiss AFB, N.Y. RADC Jun. 1982 47 p refs
(Contract F30602-79-C-0068; AF Proj. 4519)
(AD-A120486; ESL-711679-7; RADC-TR-82-184) Avail: NTIS HC A03/MF A01 CSCL 20/14

An algorithm is presented which provides the appropriate element placement of an adaptive array such that the output signal-to-interference-plus-noise ratio (SINR) of the array is above a given threshold for all desired and interference signal directions. The algorithm is used to find interelement spacings of a linear as well as a conformal array. It is shown that the structure (scattered field) affects the performance of an adaptive array mounted on a complex structure such as an aircraft fuselage. A method to take care of these effects is presented. GRA

N83-15571# Rome Air Development Center, Griffiss AFB, N.Y.
MODELING AND PROPERTIES OF MODULATED RF SIGNALS PERTURBED BY OSCILLATOR PHASE INSTABILITIES AND RESULTING SPECTRAL DISPERSION Ph.D. Thesis - May, 1982 In-House Report, Jun. 1980 - Mar. 1982
Vincent C. Vannicola Jun. 1982 176 p refs
(AF Proj. 4506)
(AD-A120406; RADC-TR-82-170) Avail: NTIS HC A09/MF A01 CSCL 17/9

This dissertation considers the problem of characterization and stochastic properties of oscillator phase instabilities. Spectral dispersion caused by such instabilities is also determined. The instabilities are modeled using white phase, random walk phase, random walk frequency random processes as well as drift phase and frequency terms. Autocorrelation functions and power spectral densities are derived for the oscillator RF output signal containing such instabilities. Furthermore, a procedure is proposed which involves the covariance matrix of the phase random process in conjunction with the characteristic function for determining the higher order moments of the RF signal. Stationary and ergodicity properties of the RF signals containing phase instabilities are discussed. In each case, conditions for ergodicity are established for the mean, autocorrelation function, and the power spectral density. The spectral dispersion generated by oscillator phase instabilities imposes limits on dynamic range and Doppler resolution in radar signal processing. This spectral dispersion is determined for the phase instability models considered in this dissertation. Modulating waveforms considered as examples include the CW, the infinite pulse train and the finite pulse train. GRA

N83-15572# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MONOPULSE ANGLE ESTIMATION FROM COHERENTLY INTEGRATED RADAR SIGNALS
Robert E. Nicholls 25 Aug. 1982 28 p
(Contract F19628-80-C-0002)
(AD-A120427; TR-619; ESD-TR-82-077) Avail: NTIS HC A03/MF A01 CSCL 17/9

A maximum likelihood estimator is derived for monopulse radar signals which have been coherently integrated. Field data from the Millstone Hill radar is reduced using the estimator and the results are compared with known values derived from an accurately computed ephemeris. GRA

N83-15573# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PACKET SPEECH SYSTEMS TECHNOLOGY Semiannual Technical Summary Report, 1 Oct. 1981 - 31 Mar. 1982
Clifford J. Weinstein and Peter E. Blankenship 31 Mar. 1982 38 p refs
(Contract F19628-80-C-0002; ARPA Order 3673; AF Proj. 2D10; AF Proj. 2T10)
(AD-A120433; ESD-TR-82-052) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report covers work in the following areas: compact vocoder development based on digital LSI technology; development of Packet Voice Terminal (PVT) and local access network (LEXNET) facilities for experiments in packet voice; development and experimental application of a flexible internet stream gateway (the miniconcentrator) for packet voice; planning, coordination, and execution of multi-user packet speech experiments on the experimental wideband satellite network (WB SATNET); and design and development of a system for voice control of network voice conferencing in the wideband system. GRA

N83-15934# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
TELEVISION INTERFERENCE AND ACOUSTIC EMISSIONS ASSOCIATED WITH THE OPERATION OF THE DARRIEUS VAWT
N. D. Kelley, R. R. Hemphill, and D. L. Sengupta (Michigan Univ.) *In its* Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 397-410 refs Sponsored in part by the National Research Council of Canada and Hydro-Quebec (For primary document see N83-15908 06-44)
(Contract EG-77-C-01-4042)
Avail: NTIS HC A23/MF A01

N83-15988# Meteorological Satellite Center, Tokyo (Japan).
AUTOMATIC MEASUREMENT OF THE SATELLITE COMMUNICATION LINK CHARACTERISTICS
Yukito Tanaka *In its* Meteorol. Satellite Center Tech. Note No. 6, 1982 Sep. 1982 p 69-72 ref In JAPANESE; ENGLISH summary (For primary document see N83-15982 06-47)
Avail: NTIS HC A05/MF A01

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N83-15574# Puerto Rico Water Resources Authority, San Juan. Dept. of Physics.
THE APPLICATION OF THE MODIFIED GOUY-CHAPMAN THEORY TO AN ELECTRICAL DOUBLE LAYER CONTAINING ASYMMETRIC IONS Interim Technical Report
L. B. Bhuiyan, L. Blum, and D. Henderson 21 Sep. 1982 20 p Prepared in cooperation with IBM Research Lab., San Jose, Calif.
(Contract N00014-81-C-0776)
(AD-A119997) Avail: NTIS HC A02/MF A01 CSCL 07/4

The modified Gouy-Chapman Theory is applied to 1:1, 2:1 and 1:2 electrolytes of unequal sizes near a flat electrode. This model features a potential of zero charge in the absence of specific adsorption. Author (GRA)

N83-15575# California Inst. of Tech., Pasadena. Dept. of Electrical Engineering and Applied Physics.
LOW-LOSS FLEXIBLE DIELECTRIC WAVEGUIDE FOR MILLIMETER-WAVE TRANSMISSION AND ITS APPLICATION TO DEVICES Annual Technical Report, 1 Nov. 1980 - 28 Feb. 1982
William B. Bridges, Marvin B. Klein (Hughes Research Labs.), and

Edgard Schweig Aug. 1982 56 p refs
(Contract N00014-79-C-0839)
(AD-A120848; SRO-005-2; CIT-82-1-ONR) Avail: NTIS HC A04/MF A01 CSCL 09/1

A finite-difference method has been developed for computing the propagation constants and field distributions for dielectric waveguides of arbitrary cross section and dielectric constant. The results of the method are compared with the exact solution for a round waveguide. Additional calculations are made for rectangular waveguides and the results compared with Marcatili's approximate solutions. Results are given for a dielectric waveguide phase shifter using a LiNbO3 waveguide. Approximately one radian of phase shift at 94 GHz was obtained with 1000 V peak audio frequency voltage applied to electrodes on the LiNbO3 waveguide. Amplitude modulation of 70% was observed in a microwave bridge configuration, in good agreement with theory. Other uses of nonlinear/electro-optic materials in the millimeter wave range are discussed, including elecronically-scanned antennas and electronically-tuned filters. Author (GRA)

N83-15576# Stanford Univ., Calif. Edward L. Ginzton Lab. of Physics.
[RESEARCH IN ACOUSTIC AND OPTICAL WAVE TECHNOLOGY] Technical Progress Report 1 Apr. 1981 - 31 Mar. 1982
A. E. Siegman, B. A. Auld, G. S. Kino, M. R. Beasley, and R. L. Byer Apr. 1982 94 p refs
(Contract N00014-75-C-0632)
(AD-A120825; GL-3411) Avail: NTIS HC A05/MF A01 CSCL 09/1

This report summaries the research progress and activity 1 April 1981 through 31 March 1982. Specific Projects are: (81-1) Interaction of Acoustic and Optical Waves with Domains in Ferroic Fibers with Bulk Materials: (B.A. Auld); (81-2) High T Josephson Junctions & Circuits (M. R. Beasley); (81-3) Optical & Nonlinear Optical Studies of Single Crystal Fibers (R. L. Byer); (81-4) Acoustic Surface Wave Scanning of Optical Images, (G. S. Kino); (81-5) Picosecond Raman Studies of Electronic Solids (A. E. Siegman). GRA

N83-15577# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.
JOINT SERVICES ELECTRONICS PROGRAM Annual Progress Report, 1 Apr. 1981 - 31 Mar. 1982
May 1982 83 p refs
(Contract N00014-75-C-0648)
(AD-A120822; APR-95) Avail: NTIS HC A05/MF A01 CSCL 09/1

Contents: Solid State Electronics; Quantum Electronics; Information and Electronics Control and Optimization; Electromagnetic Phenomena; Significant Accomplishments Report. GRA

N83-15578# Magnavox Government and Industrial Electronics Co., Fort Wayne, Ind.
DEVELOPMENT MODEL OF A MAGNETIC PARTICLES DISPLAY Final Report
L. L. Lee 22 Jun. 1982 15 p refs
(Contract N66001-81-C-0235; SF21243402)
(AD-A120121; NOSC-CR-121) Avail: NTIS HC A02/MF A01 CSCL 20/3

This report describes the technique utilized in fabricating a demonstration magnetic particle display panel of 100 x 100 addressable pixels on a 4 in. x 4 in. viewing area. GRA

N83-15579# JAYCOR, Alexandria, Va.
DESIGN, ASSEMBLY AND TESTING OF MODIFICATIONS TO THE HOMOPOLAR GENERATOR AND PLASMA SWITCH EXPERIMENTS Final Report, 6 Jul. 1981 - 22 May 1982
Robert J. Commisso, James M. Cameron, and Richard C. Crosariol 8 Oct. 1982 43 p refs
(Contract N00014-81-C-2401)
(AD-A120752; JAYCOR-J206-82-009-6215) Avail: NTIS HC A03/MF A01 CSCL 20/7

The tasks performed under this contract had application to the development of inductive energy storage. Technical expertise was provided for the standard tasks associated with HPG operation and development of a new EACB. Design and technical expertise were provided for the development (design, assembly and testing) of several plasma switch concepts. These included the plasma dynamic switch, the plasma erosion switch and the electron-beam controlled switch. GRA

N83-15580# Ohio State Univ., Columbus ElectroScience Lab.
JOINT SERVICES ELECTRONICS PROGRAM Annual Report, Oct. 1980 - Oct. 1981
Dec. 1981 117 p refs
(Contract N00014-78-C-0049)
(AD-A119895; ESL-710816-11; AR-4) Avail: NTIS HC A06/MF A01 CSCL 09/5

This report presents the fourth annual summary of research at Ohio State sponsored by the Joint Services Electronics Program (JSEP). The research is in the area of electromagnetics and the specific topics are: (1) diffraction studies; (2) hybrid techniques; (3) antenna studies; (4) time domain studies; and (5) transient signature measurements of radar targets for inverse scattering research. Sections summarize the signification accomplishments of the program and the research by work unit. Researchers and their publications are listed under each work unit. A listing of the present research programs at the Laboratory and all reports and papers published by the Laboratory during the past year are given in the appendices. GRA

N83-15581# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Mechanics and Surface Interactions Branch.
ANALYSIS OF TRAVELING WAVE TUBE MATERIALS Final Report, Oct. 1977 - Oct. 1980
B. C. Lamartine, W. V. Lampert, K. D. Rochocki, W. L. Baun, and T. W. Haas Mar. 1982 64 p refs
(AF Proj. 2303)
(AD-A120575; AFWAL-TR-81-4115) Avail: NTIS HC A04/MF A01 CSCL 09/1

A wide variety of materials are utilized in the construction of traveling wave tubes (TWT) used as microwave amplification elements for many Air Force applications. The only active component is the cathode which is heated to thermionic temperatures to serve as the electron emitting element in the electron gun section of the tube. Considerable interest exists in the correct scientific model of an activated cathode. Most such cathodes are barium-based and this research program has shown that barium in the metallic state is necessary on the surface of dispenser cathodes in order to get an acceptably low ($< \text{ or } = 1$eV) work function. Other TWT materials investigated in this program include an evaluation of the electron bombardment resistance of boron nitride insulators and the determination of the activation mechanism and characteristics of nonevaporable zirconium-graphite getters. Other failure analysis investigations of TWT's are also reported herein. Author (GRA)

N83-15582# Washington Univ., St. Louis, Mo. Dept. of Electrical Engineering.
NUMERICAL ANALYSIS OF SEMICONDUCTOR DEVICES USING MICROCOMPUTERS
P. S. L. Chen, F. J. Rosenbaum, and R. E. Goldwasser Jul. 1982 131 p refs
(Contract N00014-79-C-0840; RR0210203)
(AD-A120484; TR-82-3-ONR) Avail: NTIS HC A07/MF A01 CSCL 09/1

Simulation of the electrical properties of semiconductor devices is investigated. Numerical techniques are developed to obtain the solution of Poisson's equation and the continuity of current equation for the potential and the charge distribution interior to arbitrarily shaped devices. The emphasis is on the use of small computers. Two novel metal-semiconductor diode designs for microwave and millimeter-wave applications are examined using the techniques developed here. GRA

N83-15583# California Univ., Livermore. Lawrence Livermore Lab.
DEVELOPMENT AND MANUFACTURE OF A Nb2Sn SUPERCONDUCTOR FOR THE HIGH-FIELD TEST FACILITY
R. M. Scanlan, D. N. Cornish, C. R. Spencer (Airco Superconductors, Carteret, N.J.), E. Gregory (Airco Superconductors, Carteret, N.J.), and E. Adam (Airco Superconductors, Carteret, N.J.) 20 Oct. 1981 5 p refs Presented at 9th Symp. on Engr. Probl. of Fusion Res., Chicago, 26-29 Oct. 1981 Submitted for publication
(Contract W-7405-eng-48)
(DE82-002066; UCRL-86816; CONF-811040-31) Avail: NTIS HC A02/MF A01

The High-Field Test Facility (HFTF) project has two primary goals. The first is to establish manufacturing capability for a Nb3Sn conductor suitable or use in a mirror fusion coil. The second is to provide a test facility for evaluating other fusion conductor designs at high fields. Some of the problems encountered and the solutions devised in working toward the first goal are described. DOE

N83-15584# Oak Ridge National Lab., Tenn. Solid State Div.
ORGANIC INSULATORS AND THE COPPER STABILIZER FOR FUSION-REACTOR MAGNETS
R. R. Coltman, Jr. Nov. 1981 33 p refs Presented at Intern. Conf. on Neutron Irradiation Effects, Argonne, Ill., 9-12 Nov. 1981 Submitted for publication
(Contract W-7405-eng-26)
(DE82-004115; CONF-811145-3) Avail: NTIS HC A03/MF A01

The materials which compose the large composite superconducting fusion reactor magnets are subjected to mechanical stress, neutron and gamma ray radiation with broad energy spectra, high magnetic fields, and thermal cycling from 4 to 300 K. Of the materials considered for use in the magnets, results show that the organic isulators and the Cu stabilizer are the most sensitive to this environment. In response to the need for stabilizer data, magnetoresistivity changes were studied in eight variously prepared specimens of Cu throughout five cycles of an alternate neutron irradiation (4.0 K) and annealing (14 h 307 K) program. The results were combined with those on the radiation behavior of epoxy and polyimide organic insulators to provide a preliminary assessment of their comparative radiation resistance in a typical magnet location of the experimental power reactor (EPR). DOE

N83-15585# Los Alamos Scientific Lab., N. Mex.
BIPOLAR ENERGY-LOSS MEASUREMENTS ON CRYOSTABLE, LOW-LOSS CONDUCTORS
J. J. Wollan 1981 5 p refs Presented at the 9th Symp. on Engr. Probl. of Fusion Res., Chicago, 26 Oct. 1981
(Contract W-7405-eng-36)
(DE82-002381; CONF-811040-43) Avail: NTIS HC A02/MF A01

Losses have been measured on a prototype conductor for the 20 MJ coil for conditions which simulate closely the actual coil field sweep. The data on the prototype II conductor indicates coil losses which exceed the coil specification. The application of certain correction factors reduces the projected losses within the specification for a 2 s reversal but not for a 1 s reversal. Verification of these corrections await measurements on the actual strand and completion of coil construction and testing. DOE

N83-15586# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
GaAs MONOLITHIC MICROWAVE SUBSYSTEM TECHNOLOGY BASE Annual Technical Report, 15 Dec. 1980 - 14 Dec. 1981
J. E. Degenford, M. C. Driver, and R. G. Freitag Mar. 1982 147 p refs
(Contract N00014-81-C-0247)
(AD-A120091; Rept-82-2381) Avail: NTIS HC A07/MF A01 CSCL 09/3

During this reporting period, the effort was primarily aimed at developing a number of technologies critical to the development of a 3-W, 8-12 GHz amplifier. These technologies included 1)vias, 2) air bridges, 3) deep UV photolithography for 0.7 micrometer gates, 4) overlay capacitors. In the circuit area, 'cell cluster' matching techniques were demonstrated in a hybrid combiner circuit and several monolithic two stage amplifier were evaluated. A 5-10 GHz amplifier run incorporating vias and airbridges, was measured and produced 1 watt output from equal 5.5-9.0 GHz with 9 dB associated gain. An 8-12 GHz, two stage amplifier was also designed using 1 micrometer gate length FETs. While these FETs were not optimum for 12-GHz operation, this amplifier was predicted and measured to have a power output of 400-500 mW with 7 dB associated gain over the 8-12 GHz range. GRA

N83-15587# Los Alamos Scientific Lab., N. Mex.
HIGH-CURRENT PULSES FROM INDUCTIVE ENERGY STORES
Stefan L. Wipf 1981 7 p refs Presented at the 9th Symp. on Eng. Probl. of Fusion Res., Chicago, 26-29 Oct. 1981
(Contract W-7405-eng-36)
(DE82-004366; LA-UR-81-3421; CONF-811040-119) Avail: NTIS HC A02/MF A01

Superconducting inductive energy stores can be used for high power pulse supplies if a suitable current multiplication scheme is used. The concept of an inductive Marx generator is superior to a transformer. A third scheme, a variable flux linkage device, is suggested; in multiplying current it also compresses energy. Its function is in many ways analogous to that of a horsewhip. Superconductor limits indicate that peak power levels of TW can be reached for stored energies above 1 MJ. DOE

N83-15874# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
APPLICATIONS OF A HIGH TEMPERATURE RADIATION RESISTANT ELECTRICAL INSULATION Final Report
M. H. Cooper *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 16 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01

N83-15876# State Univ. of New York at Buffalo, Amherst.
CHARGE INJECTION EFFECTS UPON PARTIAL DISCHARGES IN A dc AND dc PLUS ac LAMINATE INSULATION ENVIRONMENT Final Report
W. J. Sarjeant, J. R. Laghari, R. Gupta, and K. J. Bickford (LASL, N. Mex.) *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 31 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 09C

N83-16136# Research Inst. of Electrical Apparatus, Brno (Czechoslovakia).
EQUIDENSITOMETRICAL EVALUATION OF A FILM RECORD OF AN SF6 SWITCHING ARC
B. Svejda and B. Gross (Technical Univ., Brno, Czechoslovakia) *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 135-138 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16138# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
SIMULATION CODE OF RELATIVISTIC ELECTRON BEAM DIODES
P. Vrba *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 153-156 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N83-15588*# Illinois Inst. of Tech., Chicago.
A NEW VIEW ON ORIGIN, ROLE AND MANIPULATION OF

LARGE SCALES IN TURBULENT BOUNDARY LAYERS Interim Report
T. C. Corke, H. M. Nagib, and Y. G. Guezennec Feb. 1982 378 p refs
(Grant NsG-1591)
(NASA-CR-165861; NAS 1.26:165861) Avail: NTIS HC A17/MF A01 CSCL 20D

The potential of passive 'manipulators' for altering the large scale turbulent structures in boundary layers was investigated. Utilizing smoke wire visualization and multisensor probes, the experiment verified that the outer scales could be suppressed by simple arrangements of parallel plates. As a result of suppressing the outer scales in turbulent layers, a decrease in the streamwise growth of the boundary layer thickness was achieved and was coupled with a 30 percent decrease in the local wall friction coefficient. After accounting for the drag on the manipulator plates, the net drag reduction reached a value of 20 percent within 55 boundary layer thicknesses downstream of the device. No evidence for the reoccurrence of the outer scales was present at this streamwise distance thereby suggesting that further reductions in the net drag are attainable. The frequency of occurrence of the wall events is simultaneously dependent on the two parameters, Re2 delta sub 2 and Re sub x. As a result of being able to independently control the inner and outer boundary layer characteristics with these manipulators, a different view of these layers emerged. S.L.

N83-15589*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPROXIMATE METHOD OF CALCULATING HEATING RATES AT GENERAL 3-DIMENSIONAL STAGNATION POINTS DURING ATMOSPHERIC ENTRY
H. Harris Hamilton, II Nov. 1982 19 p refs
(NASA-TM-84580; NAS 1.15:84580) Avail: NTIS HC A02/MF A01 CSCL 20D

An approximate method for calculating heating rates at general three dimensional stagnation points is presented. The application of the method for making stagnation point heating calculations during atmospheric entry is described. Comparisons with results from boundary layer calculations indicate that the method should provide an accurate method for engineering type design and analysis applications. E.A.K.

N83-15590*# Garrett Turbine Engine Co., Phoenix, Ariz.
DILUTION JET MIXING PROGRAM, PHASE 1
R. Srinivasan, A. Berenfeld, and H. C. Mongia Nov. 1982 236 p refs
(Contract NAS3-22110)
(NASA-CR-168031; NAS 1.26:168031; GARRETT-21-4302) Avail: NTIS HC A11/MF A01 CSCL 20D

The effect of jet to mainstream density ratio, flow area convergence as encounted in transition sections, and nonuniform mainstream profile upstream of dilution orifices on the mixing of a row of jets with a confined cross flow was quantified. It is found that: (1) jet spreading rate in transverse direction is increased with increasing J, H/D and with decreasing S/D; (2) the density ratio has only a second order effect on the jet mixing characteristics for a constant momentum ratio; (3) the temperature distributions in the jet mixing region are strongly influenced by the undisturbed mainstream profile; (4) flow area convergence enhances mixing in radial and transverse directions. An asymmetric convergent duct with flat wall injection has the same jet mixing characteristics as a symmetric convergent duct. An asymmetric convergent duct with slant wall injection has a faster jet spreading rate in the transverse direction. E.A.K.

N83-15591*# Stanford Univ., Calif. Dept of Aeronautics and Astronautics.
ON THE STRUCTURE OF AN UNDEREXPANDED RECTANGULAR JET
A. Krothapalli, Y. Hsia, D. Baganoff, and K. Karamcheti Jul. 1982 53 p refs Sponsored in part by NASA
(Contract F49620-79-0189)
(NASA-CR-169734; NAS 1.26:169734; SU-JIAA-TR-47) Avail: NTIS HC A04/MF A01 CSCL 20D

An underexpanded jet of air issuing from a converging rectangular nozzle of moderate aspect ratio was investigated. Schileren pictures of the flow field along with hot-wire measurements in the jet were obtained at different pressure ratios. At the pressure ratio corresponding to the maximum screeching sound, Schlieren photographs show a very strong organized cylindrical wave pattern on either side of the jet, with their respective sources being located at the end of the third shock cell. Associated with this wave pattern is a large increase in the angle of spread of the jet. It is shown that the self excitation helps to induce large-scale vortical motions in the jet both in the plane containing the small dimension of the nozzle and in the plane containing the long dimension of the nozzle. However, the locations of these structures are different in the two planes. Nevertheless, the characteristic Strouhal number corresponding to these large-scale structures in both planes is the same and equal to 0.12. The influence of the self excitation on the mean velocities and rms intensities was also investigated. For the full range of pressure ratios studied, similarity was found in the mean velocity and rms intensity profiles in the two central planes beyond 80 widths downstream of the nozzle exit. However, the shapes of the similarity profiles are different in the two planes. M.G.

N83-15592*# Arizona State Univ., Tempe. Dept. of Mechanical and Aerospace Engineering.
JET ARRAY IMPINGEMENT FLOW DISTRIBUTIONS AND HEAT TRANSFER CHARACTERISTICS. EFFECTS OF INITIAL CROSSFLOW AND NONUNIFORM ARRAY GEOMETRY Final Report
L. W. Florschuetz, D. E. Metzger, C. C. Su, Y. Isoda, and H. H. Tseng Washington NASA Nov. 1982 178 p
(Contract NsG-3075)
(NASA-CR-3630; NAS 1.26:3630; ERC-R-82038) Avail: NTIS HC A09/MF A01 CSCL 20D

Two-dimensional arrays of circular air jets impinging on a heat transfer surface parallel to the jet orifice plate are considered. The jet flow, after impingement, is constrained to exit in a single direction along the channel formed by the jet orifice plate and the heat transfer surface. The configurations considered are intended to model those of interest in current and contemplated gas turbine airfoil midchord cooling applications. The effects of an initial crossflow which approaches the array through an upstream extension of the channel are considered. Flow distributions as well as heat transfer coefficients and adiabatic wall temperatures resolved to one streamwise hole spacing were measured as a function of the initial crossflow rate and temperature relative to the jet flow rate and temperature. Both Nusselt number profiles and dimensionless adiabatic wall temperature (effectiveness) profiles are presented and discussed. Special test results which show a significant reduction of jet orifice discharge coefficients owing to the effect of a confined crossflow are also presented, along with a flow distribution model which incorporates those effects. A nonuniform array flow distribution model is developed and validated. M.G.

N83-15593# Argonne National Lab., Ill. Engineering Div.
FLOW FIELD DEVELOPMENT IN MHD DIFFUSERS AND SECONDARY FLOW EFFECTS IN DIAGONAL MHD CHANNELS
R. K. Ahluwalia and S. P. Vanka Aug. 1982 31 p refs Backup document for AIAA Synoptic scheduled for publication in the Journal of Energy on July-Aug. or Sep.-Oct. 1983 Sponsored by DOE
Avail: NTIS HC A03/MF A01

Detailed three dimensional calculations are made to study the generation of secondary flows in conducting and insulating sidewall diagonal channels. The secondary flows have considerable influence on the velocity overshoots, momentum and thermal mixing, flow asymmetry, and the power output. They tend to diminish the velocity overshoots, to promote mixing, and to

introduce flow asymmetry. The gross predictions of the three dimensional model are compared with the experimental data and found to be in good agreement. S.L.

N83-15594# Iowa Inst. of Hydraulic Research, Iowa City.
EFFECT OF BOUNDARY LAYER ON THRUST DEDUCTION Final Report, Oct. 1978 - Oct. 1980
S. P. G. Dinavahi and L. Landweber Nov. 1981 49 p refs
(Contract N00014-79-C-0243)
(AD-A119799; IIHR-239) Avail: NTIS HC A03/MF A01 CSCL 13/10

It is noted that methods of computing thrust deduction usually ignore viscous effects and assume that the flow field of the ship and propeller is irrotational. The computed values of the thrust deduction with and without the boundary layer and wake were compared. A streamlined body of revolution was selected, and a sink on the axis behind the body was used as a simple mechanism to simulate the suction at the stern induced by a propeller. When the boundary layer and wake are present, the thick boundary near the tail of the body is first calculated by a previously developed method in which the equation of a thick boundary layer and wake are solved numerically by finite differences, and the outer irrotational flow is obtained as the solution of an integral equation. An iteration procedure in which the inner and outer flows are successively adjusted converges to the desired solution. It was found that results obtained in the wake were not sufficiently accurate, so that a momentum analysis using a special control volume was used to calculate the viscous drag with and without the sink. The calculated values of the thrust deuction are C sub D = 0.00021 from irrotational flow and 0.00043 from the boundary layer potential-flow interaction method. M.G.

N83-15595# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.
VORTICITY GENERATION BY ASYMMETRIC ENERGY DEPOSITION IN A GASEOUS MEDIUM Interim Report
J. P. Boris and J. M. Picone 16 Sep. 1982 56 p refs
(AD-A119961; NRL-MR-4854) Avail: NTIS HC A04/MF A01 CSCL 20/4

This paper develops in detail the theory of vorticity generation by asymmetries which are presented when a cylindrical pulse of energy is deposited in a gaseous medium. We identify three classes of asymmetry which may occur separately or in combination, depending on the experiment being analyzed. We also introduce a convenient representation of the flow field in terms of one or more vortex filament pairs having identical strengths. The equations which give the vortex filament strength for the various asymmetry classes differ only in the value of a form factor, which contains information regarding geometric effects and hydrodynamic interactions. The form factor, however, depends only weakly on the profile of the density distribution of the medium prior to energy deposition. Finally we verify and calibrate the analytic results by providing data from accurate two-dimensional simulations of several cases. The analytical and numerical calculations agree closely for all examples considered. Author GRA

N83-15596# Ballistic Research Labs., Aberdeen Proving Ground, Md. Ballistic Research Lab.
PRESSURE MOMENT ON A LIQUID-FILLED PROJECTILE: SOLID BODY ROTATION Final Report
Nathan Gerber, Raymond Sedney, and Joan M. Bartos Oct. 1982 65 p refs Supersedes ARBRL-IMR-744
(DA Proj. 1L1-61102-AH-43)
(AD-A120567; AD-F300092; ARBRL-TR-02422; ARBRL-IMR-744) Avail: NTIS HC A04/MF A01 CSCL 19/1

The liquid produced moment on a liquid filled spinning cylinder executing angular motion is determined, where the liquid originally is in solid body rotation. In an approximation to free flight spiraling motion of a projectile, the cylinder is nutating at constant frequency about a point on its axis and is undergoing timewise exponential yaw growth. The assumption of small yaw angle permits the formulation of a linearized viscous flow problem as a perturbation on solid body rotation. The pressure obtained from the resulting linearized flow is used to obtain the moment. Moment due to shear stresses is not considered. This moment is incorporated into the dynamical equations of gyroscopic motion to determine yaw growth rate and mutational frequency. This report provides a presentation of the equations and computational procedures. The approach is to apply a modal analysis in the flow solution which gives rise to ordinary differential equations, and then to make a correction required to compensate for neglect of the no slip conditions at the endwalls in the modal analysis. Results are compared with those of other theoretical work and with experimental data for endwall pressure, pressure moment, and yaw growth rate of projectiles and gyroscopes. In general, results agree well for high Reynolds number. Relative discrepancies are more prominent at low Reynolds numbers, particularly in yaw growth rate data. Qualitative agreement of present results with concurrent theoretical work of Murphy appears to be consistently good. GRA

N83-15597# Kalamazoo Coll., Mich. Dept. of Chemistry.
MODELING THE MOVING BOUNDARY PROBLEM FOR TES WITH PCMS
R. M. Deal 1981 5 p refs Presented at the Ann. Contractors' Rev. Meeting on Thermal and Chem. Storage, Tysons Corner, Va., 16 Sep. 1981
(Contract W-7405-eng-26)
(DE82-000118; CONF-810940-25) Avail: NTIS HC A02/MF A01

A simple numerical procedure for calculating the flow of heat in a one dimensional phase change material developed by Budak has been tested against an analytical solution to determine the best choice of parameters for a range of Stefan numbers. Simple rules are provided by which an inexperienced user of the method can obtain reasonably reliable results for a simply melting substance. DOE

N83-15598# AiResearch Mfg. Co., Torrance, Calif.
HEAT EXCHANGER FOULING AND CORROSION EVALUATION Final Technical Report
E. DeAnda 25 Oct. 1981 233 p refs
(Contract DE-AC22-77ET-11296)
(DE82-002529; DOE/ET-11296/T21) Avail: NTIS HC A11/MF A01

The experimental determination of acid corrosion and fouling effects upon a series of tubular heat exchanger modules exposed to the exhaust gases from a large (8900-hp) diesel engine, with different fin geometries and materials was studied. A study of the exhaust gas analysis was undertaken and acid dew point temperatures were determined. Heat exchanger test modules were then operated with metal surface temperatures below the acid dew point to allow for acid condensation and fouling. A continuous soot buildup was observed on the heat exchanger, as a function of the diesel engine operating time, heat transfer metal surface temperature, and fin geometry. The corrosion effects on the heat exchangers were minimal. DOE

N83-15599# Argonne National Lab., Ill. Components Technology Div.
THREE-DIMENSIONAL SIMULATION OF DIVERSION CROSS-FLOW BETWEEN TWO PARALLEL CHANNELS CONNECTED BY A NARROW SLOT USING THE COMMIX-1A COMPUTER PROGRAM
H. P. Fohs (Northwestern Univ.), R. W. Lyczkowski, and W. T. Sha Oct. 1981 65 p refs
(Contract W-31-109-eng-38)
(DE82-004048; ANL-CT-81-34) Avail: NTIS HC A04/MF A01

The predictive capabilities of the COMMIX-1A computer program by simulating a fundamental experiment which determined diversion cross flow and pressure drops between and along two parallel square channels connected by a narrow lateral slot are demonstrated. The COMMIX-1A predicted correct trends and fairly accurate flow quantities with minimum empirical input. DOE

N83-15251# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL STUDY ON HEAT TRANSFER TO ROUGH

WALLS
Tian Wenbing (Beijing Inst. of Aerodynamics), Li Xue (Beijing Inst. of Aerodynamics), and Mao Mingfang (Beijing Inst. of Aerodynamics) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 25-45 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

N83-15890# Washington Univ., Seattle.
THE LIQUID DROPLET RADIATOR Final Report
A. T. Mattick, A. Hertzberg, and R. Taussig (Mathematical Sciences Northwest, Inc., Bellevue, Wash.) *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 15 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20D

N83-15891# Washington Univ., Seattle.
THE LIQUID DROPLET HEAT EXCHANGER Final Report
A. P. Bruckner *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 12 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20D

N83-15892# Thermacore, Inc., Lancaster, Pa.
THE NEED FOR IMPROVED HEAT PIPE FLUIDS Final Report
D. M. Ernst and G. Y. Eastman *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 15 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20D

N83-15893# Thermacore, Inc., Lancaster, Pa.
ENHANCED HEAT PIPE THEORY AND OPERATION Final Report
D. M. Ernst and G. Y. Eastman *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 24 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20D

N83-15894# Little (Arthur D.), Inc., Cambridge, Mass.
TWO-PHASE HEAT TRANSPORT FOR THERMAL CONTROL Final Report
A. A. Fowle *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 18 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20D

N83-15895# Little (Arthur D.), Inc., Cambridge, Mass.
LIQUID RIBBON RADIATOR FOR LIGHTWEIGHT SPACE RADIATOR SYSTEMS Final Report
W. P. Teagan *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 13 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N83-15600*# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology and Physical Oceanography.

METEOROLOGICAL ANALYSIS OF MAPS FIRST SHUTTLE FLIGHT Final Technical Report
Mark Doherty and Reginald E. Newell 11 Jan. 1983 5 p refs (Grant NAG1-292)
(NASA-CR-169739; NAS 1.26:169739) Avail: NTIS HC A02/MF A01 CSCL 14B

The data from the MAPS radiometer launched on board the first shuttle flight was analyzed. The meteorological data relevant to the MAPS measurements was also analyzed so that the in situ calibration measurements and any anomalous features within the data set can be evaluated in the context of the atmospheric circulation during the period of observation. The three dimensioned isentropic analysis scheme was used as the main analytical tool. A graphical output of the N and delta channel signals, black body reference temperatures, reduced CO concentrations and ground tracks for orbits 15 and 16 were provided. The insentropic trajectory methods was emphasized because it is a basic requirement that the analysis be extended to incorporate daily data within the tropics. S.L.

N83-15601*# Auburn Univ., Ala. Dept. of Mechanical Engineering.
MANUAL FOR EXTENDING THE LASER SPECKLEGRAM TECHNIQUE TO STRAIN ANALYSIS OF ROTATING COMPONENTS Final Report
L. C. Chien, J. L. Turner, John Weathers, and W. F. Swinson Nov. 1982 79 p refs
(Grant NAG3-103)
(NASA-CR-167932; NAS 1.26:167932) Avail: NTIS HC A05/MF A01 CSCL 14B

The theory, techniques, and equipment necessary for extending laser speckle techniques to analyze stresses in rotating blades are described. Details for setting up the equipment, for timing the events, for data recording, and for data analysis are discussed. Finite element techniques are investigated for analysis of speckle data. Advantages and limitations of the finite element analysis for the speckle data are discussed. The finite element program is listed. M.G.

N83-15602*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL FEASIBILITY STUDY OF A THERMOELECTRIC HEAT FLUX GAGE
G. James VanFossen, Jr. and Isaac Lopez 1983 10 p refs Proposed for presentation at the Thermal Eng. Joint Conf., Honolulu, Hawaii, 20-24 Mar. 1983; sponsored by the American Society of Mechanical Engineers and the Japan Society of Mechanical Engineers Prepared in cooperation with Army Aviation Research and Development Command, Cleveland
(NASA-TM-83048; E-1498; NAS 1.15:83048; AVRADCOM-TR-82-C-17) Avail: NTIS HC A02/MF A01 CSCL 14B

An experiment was conducted to determine the feasibility of using a commercially available thermoelectric device as a heat flux gage at near ambient conditions. In certain research applications, the thermoelectric heat flux gage can provide a relatively simple means to model a warm fluid cold wall convection environment. The experiment showed that heat flux through the gage could be correlated within 2.5 percent with a simple algebraic equation which considered the thermoelectric current through the device and the hot and cold side temperatures. Author

N83-15603*# Arizona Univ., Tucson.
STUDY OF PHOTOCONDUCTIVE INDIUM ANTIMONIDE
F. J. Low and E. T. Young Dec. 1982 7 p refs
(Grant NAG2-154)
(NASA-CR-166423; NAS 1.26:166423) Avail: NTIS HC A02/MF A01 CSCL 14B

Indium antimonide (InSb) material was assessed for use as photoconductive infrared detectors under low background conditions. Such detectors must be more rugged, and have lower capacitance, than the common photovoltaic InSb detector. Electronic grade n-type InSb was etched to 50 micrometers

thickness, and tin and gold contacts were applied by evaporation. The test devices showed a relatively low ultimate impedance: 7 Mohms at 4.2 K. This was attributed to the presence of impurity levels of very shallow energies, and this material was judged unsuitable for low background detection. S.L.

N83-15604# Texas Instruments, Inc., Dallas. Equipment Group.
INVESTIGATION OF AN EXPLORATORY DEVELOPMENT MODEL OF THE 3HE FREE PRECESSION GRADIOMETER Final Report
Douglas D. McGregor 26 Feb. 1982 66 p refs
(Contract N60921-81-C-0264)
(AD-A120016) Avail: NTIS HC A04/MD A01 CSCL 20/3

This report describes the results of an investigation of an exploratory development model (XDM) of the 3He free precession gradiometer. The gradiometer is intended for use in a mine application. The investigation included the construction and evaluation of the XDM 3He gradiometer, an experiment to determine the effect of sensor orientation, an experiment to assess the effect of magnetic gradients on the magnetometer operation, and a detection test in which a magnet of known strength was carried on a straight line path past the gradiometer. Author (GRA)

N83-15605# International Business Machines Corp., San Jose, Calif.
APPLICATIONS OF HOLOGRAPHY IN THE INVESTIGATIONS OF PHOTOCHEMICAL REACTIONS
Donald M. Burland 7 Oct. 1982 33 p refs
(Contract N00014-81-C-0418)
(AD-A120787; Rept-2) Avail: NTIS HC A03/MF A01 CSCL 20/6

The use of holography to investigate photochemical reactions is described. The experimental and theoretical bases for the technique are treated. Several specific applications are discussed including determination of the number of photons involved in a photochemical process, unraveling of a complex sequence of photochemcial reactions and investigation of photochemistry that occurs from higher triplet states. GRA

N83-15606# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
TWO-DIMENSIONAL SIGNAL PROCESSING AND STORAGE AND THEORY AND APPLICATIONS OF ELECTROMAGNETIC MEASUREMENTS Annual Report, 1 Apr. 1981 - 31 Mar. 1982
R. W. Schafer and D. T. Paris Aug. 1982 24 p refs
(Contract DAAG29-81-K-0024)
(AD-A119882) Avail: NTIS HC A02/MF A01 CSCL 09/1

Contents: constrained iterative signal restoration; spectrum analysis and parametric modelling; signal reconstruction from partial phase and magnitude information; multiprocessor architectures for digital signal processing; two-dimensional optical storage and processing; hybrid optical/digital processing; electromagnetic measurements in the time domain; and automated radiation measurements for near and far field transformation. GRA

N83-15607# Los Alamos Scientific Lab., N. Mex.
SAFEGUARDS INSTRUMENT TO MONITOR SPENT REACTOR FUEL
Nicholas Nicholson, Edward J. Dowdy, David M. Holt, and Charles Stump 1981 5 p refs Presented at the IEEE Symp. on Nucl. Sci., San Francisco, 21-23 Oct. 1981
(Contract W-7405-eng-36)
(DE82-002373; LA-UR-81-3077; CONF-811012-20) Avail: NTIS HC A02/MF A01

A hand held instrument for monitoring irradiated nuclear fuel inventories located in water filled storage ponds has been developed. This instrument provides sufficient precise qualitative and quantitative information to be useful as a confirmatory technique to International Atomic Energy Agency inspectors, and is believed to be of potential use to nuclear fuel managers and to operators of spent fuel storage facilities, both at reactor and away from reactor, and to operators of nuclear fuel reprocessing plants. Because the Cerenkov radiation glow can barely be seen by the unaided eye under darkened conditions, a night vision device is incorporated to aid the operator in locating the fuel assembly to be measured. Beam splitting optics placed in front of the image intensifier and a preset aperture select a predetermined portion of the observed scene for measurement of the light intensity using a photomultiplier (PM) tube and digital readout. The PM tube gain is adjusted by use of an internal optical reference source, providing long term repeatability and instrument to instrument consistency. Interchangeable lenses accommodate various viewing and measuring conditions. DOE

N83-15608# Department of Energy, New York. Environmental Measurements Lab.
EVALUATION OF COMMERCIALLY AVAILABLE TLD READERS
John Gulbin and G. dePlanque Oct. 1981 26 p refs
(DE82-002447; DOE/EML-396) Avail: NTIS HC A03/MF A01

The performance of two commercially available thermoluminescence bulb dosimetry systems, the Victoreen 2810 Ultra Sensitive TLD Reader and the Harshaw Model 2000P Bulb Dosimetry System, was investigaed. Of primary interest was the reliability of the instruments at an exposure range typically encountered in environmental radiation when monitoring on a monthly basis, i.e., approx. 10 mR. Uniformity, linearity, and reproducibility test results are reported. The two systems found to perform comparably well as bulb readers. Evaluation of the dual capability of the Victoreen 2810 as a chip reader is also described. DOE

N83-15609# Washington Univ., Seattle. Dept. of Physics.
ION CHAMBERS FOR FLUORESCENCE AND LABORATORY EXAFS DETECTION
E. A. Stern, W. T. Elam, B. A. Bunker, Kun-quan Lu (Academic Sinica, Peking), and S. M. Heald (Brookhaven National Lab.) 1981 9 p refs Presented at the 2nd Natl. Conf. on Synchrotron Radiation Instrumentation, Ithaca, N.Y., 15 Jul. 1981
(Contracts DE-AC02-76CH-00016; DE-AS05-80ER-10742; Grant NSF PCM-79-03674)
(DE82-001818; BNL-30165; CONF-810750-11) Avail: NTIS HC A02/MF A01

It is possible to design gas ionization chambers with a noise equivalence of 1000 photons per second for 10 keV x-radiation. With such a low noise level, ion detectors can be used for laboratory EXAPS facilities and fluorescence detectors at national synchrotron facilities where the detected signal is above 1000 photons/s. In such use the ion chambes are limited by statistical noise and produce as good a signal to noise as counting detectors. The advantages of ion chambers are simplicity, high linearity at high counting rates and large detecting area. DOE

N83-15610# Sandia Labs., Albuquerque, N. Mex.
CALIBRATION TECHNIQUES FOR A LARGE COMPUTERIZED WAVEFORM RECORDING SYSTEM
W. B. Boyer 1981 18 p refs Presented at Waveform Recorder Seminar, Boulder, Colo., 15 Oct. 1981
(Contract DE-AC04-76DP-00789)
(DE82-001913; SAND-81-2089C; CONF-811080-1) Avail: NTIS HC A02/MF A01

A transient waveform recording and processing facility was developed for a particle beam fusion accelerator, PBFA-I. Signals from diagnostic monitors on the accelerator and associated experiments consist of transient pulses of 10 to 1000 ns duration and 1 to 5000 volts peak amplitude. The waveform recording system consists of 44 transient digitizers interfaced to a HP-1000/45 minicomputer. The facility also contains computer controlled calibration, switching, and attenuation devices. DOE

N83-15611# Hanford Engineering Development Lab., Richland, Wash.
BUFFON NEEDLE METHOD OF TRACK COUNTING
R. Gold, J. H. Roberts, and F. H. Ruddy 1981 8 p refs Presented at the 11th Intern. Conf. on Solid Nucl. Track Detectors, Bristol, UK, 7 Sep. 1981
(Contract DE-AC06-76FF-02170)

(DE82-003774; HEDL-SA-2381-FP; CONF-8109100-2) Avail: NTIS HC A02/MF A01

A technique of quantitative track counting, the Buffon needle method, is advanced. It is based on random sampling of the solid state track recorder (SSTR) surface. This method extends quantitative track scanning to track densities well up into the track pileup regime. It is shown that the Buffon needle method possesses a reduced dependence upon both track density nonuniformity and track size distribution. Sources of experimental error arising in the Buffon needle method are assessed. The validity of the Buffon needle method is demonstrated down to at least the 10% uncertainty level by manual sampling of high fission track density mica SSTR observed with scanning electron microscopy. DOE

N83-15612# Atomic Energy Research Establishment, Harwell (England). Materials Physics Div.
EVALUATION OF A COMPUTER AIDED X-RAY FLUOROGRAPHIC SYSTEM. PART 1: SYSTEM ANALYSIS
S. F. Burch and S. J. Cocking Feb. 1982 46 p refs 2 Vol.
(AERE-R-10409-Pt-1) Avail: NTIS HC A03/MF A01

A computer aided, X-ray fluorographic (CAF) system has been assembled for application in non-destructive testing. The fluorographic hardware comprises a rare earth phosphor viewed with a low-light level SIT (silicon intensifier target) TV camera. This is a robust, adaptable and relatively low cost combination, suitable for real time imaging in an industrial environment. The important addition of the digital image processor allows integration to reduce noise and hence increase the thickness sensitivity of the system. Measurements of the resolution of the system and the noise on the fluorographic images are presented. The modulation transfer function (MTF), which gives a comprehensive description of resolution, has been measured for the complete system and for the optical imaging components alone. These data show that for the highest resolution phosphor used a 10% MTF at 4 cycles/mm can be achieved when a specimen area of width less than 50 mm is imaged. For larger areas the TV camera limits the resolution so that lower resolution, but more sensitive, phosphors can be used without loss of image quality. Higher resolution for the larger areas would be available with a larger format TV camera tube. Author

N83-15613# Atomic Energy Research Establishment, Harwell (England). Materials Physics Div.
EVALUATION OF A COMPUTER AIDED X-RAY FLUOROGRAPHIC SYSTEM. PART 2: IMAGE PROCESSING
S. F. Burch and S. J. Cocking Dec. 1981 12 p 2 Vol.
(AERE-R-10410-Pt-2) Avail: NTIS HC A02/MF A01

The TV imagery from a computer aided X-ray fluorographic system has been digitally processed with an I2S model 70E image processor, controlled by a PDP 11/60 minicomputer. The image processor allowed valuable processing for detection of defects in cast components to be carried out at television frame rates. Summation of TV frames was used to reduce noise, and hence improve the thickness sensitivity of the system. A displaced differencing technique and interactive contrast enhancement were then used to improve the reliability of inspection by removing spurious blemishes and interferences lines, while simultaneously enhancing the visibility of real defects. The times required for these operations are given, and the benefits provided for X-ray fluorography are illustrated by the results from inspection of aero engine castings. Author

36 LASERS AND MASERS

Includes parametric amplifiers.

N83-15614*# Johns Hopkins Univ., Baltimore, Md. Dept. of Electrical Engineering and Computer Science.
DYE LASER TRAVELING WAVE AMPLIFIER Interim Status Report, Dec. 1980 - Dec. 1982
Frederic Davidson Jan. 1983 25 p
(Contract NCC5-24)
(NASA-CR-169718; NAS 1.26:169718) Avail: NTIS HC A02/MF A01 CSCL 20E

A flash lamp pumped dye laser suitable for use as an amplifier stage was developed. The desired output laser pulses are of nanosecond duration, tunable in center frequency, and of good optical quality. Its usefulness as a laser oscillator is emphasized, because it constitutes a compact, relatively efficient source of tunable dye laser light. S.L.

N83-15615# Arizona Univ., Tucson. Optical Sciences Center.
COHERENT TRANSIENT EFFECT STUDIES OF RYDBERG ATOMS Final Report
Richard L. Shoemaker and William H. Wing Sep. 1982 28 p refs
(Contract N00014-79-C-0488; NR Proj. 393-041; RR0110301)
(AD-A120535) Avail: NTIS HC A03/MF A01 CSCL 20/5

New techniques for making time resolved studies of atoms in highly excited (Rydberg) states were investigated. In particular, attempts were made to observe coherent transient effects produced via CO2 laser irradiation, from a high density atomic Rydberg vapor produced by stepwise dye laser excitaion, but no such effects were observable. It was found that this result was due to a very rapid collisional decay process which occurs in a Rydberg gas at the densities required for transient experiments (approx 10 to the 12th power atoms/cu cm). The decay process was studied using ion collection and fluorescence collection and fluoresence techniques. Author (GRA)

N83-15616# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FANSHAPED SUPERRADIANCE OF A DYE LASER
Xipo Wang and Guifang Peng 22 Sep. 1982 5 p Transl. into ENGLISH from Jiguing (China), v. 9, no. 3, Mar. 1982 p 174
(AD-A120732; FTD-ID(RS)T-1239-82) Avail: NTIS HC A02/MF A01 CSCL 20/5

The experimental apparatus used to achieve fan shaped superradiance of a dye laser by using second harmonics from a giant pulsed YAP:Nd(3+) laser oscillator-amplifier to pump Rhodamine 6G is described. The laser device employs a single 45 deg LiNbO3 electro-optical Q-switched yttrium aluminate laser as the oscillation stage, and after one stage of oscillation of yttrium aluminate laser amplification, it puts out a laser peak power of approximately 30 MW, with a repetition rate of once per second; using LiLO3 (I type phase matching, theta m approximately 30 deg) outer cavity frequency doubling, it puts out 0.539 micrometer frequency doubled light, with a peak power of 1.8 MW; and then uses the 0.539 micrometer frequency doubled light to pump Rhodamine 6G laser dye. The emission obtained assumes a fan shape which is planar. A.R.H.

N83-15617# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH-SPEED SCAN ROTATING MIRRORS FOR HIGH ENERGY LASER SYSTEMS
Shaoyi Hu 22 Sep. 1982 16 p Transl. into ENGLISH from Jiguing (China), v. 7, no. 12, 1980 p 27-31
(AD-A120728; FTD-ID(RS)T-0774-82) Avail: NTIS HC A02/MF A01 CSCL 20/5

Two types of periodic scan rotation mirrors used in high energy laser systems are introduced. Both rotating mirrors are driven by air turbines: one is supported by a hydrostatic gas bearing while the other is supported by three holding wheels centerlessly. Their design, fabrication and experimental results are described. Author (GRA)

N83-15618# Westinghouse Research and Development Center, Pittsburgh, Pa.
MERCURY BROMIDE DISCHARGE LIFE STUDIES Final Report, 1 May 1981 - 31 Jan. 1982
C. S. Liu and I. Liberman 3 Aug. 1982 15 p refs
(Contract N00014-81-C-0485)
(AD-A120098) Avail: NTIS HC A02/MF A01 CSCL 20/5

This report summarizes research work performed at the

Westinghouse R/D Center under ONR Contract No. N00014-81-C-0485 for the period between May 1, 1981 and January 31, 1982. The major effort was to perform experimental lifetime studies of the HgBr laser system, and to verify noble metal electrodes for long life operation in HgBr laser discharges. In this report, the results of experimental life tests of gold and platinum electrodes for HgBr lasers are presented. The life expectancy of such electrodes is over 10 to the 8th power shots or 300 hours at 100 pulses per second. The possibility of extending its life to 10 to the 10th power shots is discussed. GRA

N83-15619# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
A GENERAL ALGORITHM FOR THE CALCULATION OF LASER BEAM SPREADING Final Report
M. B. Richardson Aug. 1982 31 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A120674; ERADCOM/ASL-TR-0116) Avail: NTIS HC A03/MF A01 CSCL 20/5

This paper compares two different beam spreading formalisms in the limits of near-and far-field, short exposure and long exposure. A description is given of an interpolation algorithm bridging the limits, giving entirely reasonable results in the intermediate regimes while having the proper limiting values. GRA

N83-15620# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A RADIAL ELECTRON BEAM FOR PUMPING LASERS
Ge Qi, Xu Shanshan, Wang Yuepo, and Wang Peigang 8 Sep. 1982 14 p refs Transl. into ENGLISH from Dianzixue Tongxun (China), no. 1, 1981 p 39-44
(AD-A119853; FTD-ID(RS)T-0789-82) Avail: NTIS HC A02/MF A01 CSCL 20/7

The radial relativistic electron beam was studied for use as a gas laser pumping source. The design and experimental results of a coaxial electron gun for the production of a radial electron beam are obtained and certain characteristics of this kind of beam are discussed. With such a beam, laser output in the ultraviolet region is obtained successfully. Author (GRA)

N83-15621# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CO2-N2 LASER USING THE COMBUSTION HEAT OF ACETYLENE
Michael Syczewski 8 Sep. 1982 16 p refs Transl. into ENGLISH from Arch. Termodyn. i Spalania (Poland), v. 6, no. 4, 1975 p 585-592
(AD-A119854; FTD-ID(RS)T-0951-82) Avail: NTIS HC A02/MF A01 CSCL 20/5

The test stand of a gasodynamic laser based on the use of the products and energy of acetylene combustion is described. The results of studies are presented and theoretical parameters of the stream of gases in the area of resonance cavity are determined. It is found that acetylene can serve as a good fuel for a gasodynamic laser under the condition that sufficient cooling of the products in resonance cavity is accertained. Author (GRA)

N83-15622# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LASER JOURNAL (SELECTED ARTICLES)
10 Sep. 1982 48 p ref Transl. into ENGLISH from Jiguang (China), v. 9, no. 2, Feb. 1982 p 88-89, 93-105 and 126
(AD-A119832; FTD-ID(RS)T-0954-82) Avail: NTIS HC A03/MF A01 CSCL 20/5

A recombination laser of Xe plasma produced in a gaseous mixture of He and Xe with a CO2 laser pulse of 10.6 micron wavelength is reported. The particle number is the result of electron-ion recombination. An experimental technique for producing coherent anti-stokes Raman scattering with a pico-second tunable laser in benzene is studied. For individual titles, see N83-15623 through N83-15623.

N83-15623# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RECOMBINATION LASER BY LASER-PRODUCED XENON PLASMAS
La Lanying, Lu Zaitong, Zhang Dounan, and Wang Zemin *In its* Laser J. (Selected Articles) (FTD-ID(RS)T-0954-82) 10 Sep. 1982 p 1-4 ref Transl. into ENGLISH from Jiguang (China), v. 9, no. 2, Feb. 1982 (For primary document see N83-15622 06-36)
Avail: NTIS HC A03/MF A01 CSCL 20/5

A recombination laser of Xe plasma produced in a gaseous mixture of He and Xe with a CO2 laser pulse of 10.6 micron wave is reported. The particle number is the result of electron-ion recombination. The wavelength of the Xe recombination laser obtained in the experiment is 2.03 microns with an output power of more than 80 watts and a pulse width of 2 microsec. The input CO2 laser energy is supplied by a CO2 laser with cold cathode electron beam controlled discharge. Each pulse has an energy of over 30 joules (pulse width 1 to 2 microsec). After being reflected by a cylindrical reflector of 6 cm focal length in the target chamber, the CO2 laser beam is focussed on a metal target 8 cm long 3 mm wide. At the two ends of the chamber are Brewster angle windows at 2.03 microns made by quartz plates. S.L.

N83-15624# Los Alamos Scientific Lab., N. Mex.
AUTOMATED COMPUTER ANALYSIS OF X-RAY RADIOGRAPHS GREATLY FACILITATES MEASUREMENT OF COATING-THICKNESS VARIATIONS IN LASER-FUSION TARGETS
D. M. Stupin, K. R. Moore, G. D. Thomas, and R. L. Whitman 1981 16 p refs Presented at the 28th Am. Vacuum Soc. Natl. Symp., Anaheim, Calif., 3-6 Nov. 1981
(Contract W-7405-eng-36)
(DE82-002353; LA-UR-81-3027; CONF-811113-26) Avail: NTIS HC A02/MF A01

An automated system was built to analyze X-ray radiographs of laser fusion targets which greatly facilitates the detection of coating thickness variations. Many laser fusion targets require opaque coatings 1 to 20 micron thick which were deposited on small glass balloons 100 to 500 micron in diameter. These coatings must be uniformly thick to 1% for the targets to perform optimally. Our system is designed to detect variations as small as 100 A in 1 micron thick coatings by converting the optical density variations of contact X-ray radiographs into coating thickness variations. Radiographic images are recorded in HRP emulsions and magnified by an optical microscope, imaged onto television camera, digitized and processed on a Data General S/230 computer. After an initial set up by the operator, as many as 200 targets will be automatically characterized. DOE

N83-15625# Los Alamos Scientific Lab., N. Mex.
RESULTS OF THE LOS ALAMOS NATIONAL LABORATORY FREE-ELECTRON LASER EXPERIMENT
R. W. Warren (Westinghouse Research Lab.), B. E. Newnam, L. M. Young, W. E. Stein, J. G. Winston, and C. A. Brau 1981 3 p refs Presented at the IEEE Intern. Conf. on Infrared and Millimeter Waves, Miami Beach, Fla., 7-12 Dec. 1981 Sponsored in part by AFOSR, DARPA, and Naval Air Systems Command
(Contract W-7405-eng-36)
(DE82-002364; LA-UR-81-3015; CONF-811204-2) Avail: NTIS HC A02/MF A01

An experiment to test a high power, high efficiency free-electron laser (FEL) was conducted. The principal components are described and preliminary results are presented. DOE

N83-15626# Atomic Energy Research Establishment, Harwell (England). Metallurgy Div.
DYNAMIC ELASTIC DISPLACEMENTS DUE TO PULSED LASER ABSORPTION AT THE SURFACE OF AN INFINITE PLATE
H. N. G. Wadley, J. A. Simmon, and C. K. Stockton Apr. 1982 29 p refs
(AERE-R-10401) Avail: NTIS HC A03/MF A01

The thermoelastic strain accompanying absorption of pulsed laser radiation was modelled as a combination of elementary force dipoles. The elastic displacements due to each dipole component

and the complete source were calculated using the dynamic elastic Green's tensor for an infinite plate. The results for a typical laser pulse incident on an austenitic steel plate show that as the source-receiver distance increases, the elastic displacements become dominated by a Rayleigh wave on the plate surface where absorption occurs, and by head waves on the surface opposite the source. M.G.

N83-15862# Illinois Univ., Urbana. Fusion Studies Lab.
STATUS, RESEARCH REQUIREMENTS AND POTENTIAL APPLICATIONS FOR NUCLEAR PUMPED LASERS Final Report
George H. Miley *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 30 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10A

N83-16126# Purkyne (J. E.) Univ., Kotlarska (Czechoslovakia). Dept. of Physical Electronics.
COATING OF LASER FUSION TARGETS BY PLASMA POLYMERIZED ORGANIC THIN FILMS
J. Janoa *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 103-104 (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16128# Technical Univ. of Prague (Czechoslovakia).
ION VELOCITY MEASUREMENTS FOR LASER MASS ABLATION STUDIES
L. Pina *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 107-108 (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N83-15627*# Detroit Diesel Allison, Indianapolis, Ind.
ADVANCED GAS TURBINE (AGT) POWER-TRAIN SYSTEM DEVELOPMENT Semiannual Report, 1 Jul. - 31 Dec. 1981
H. E. Helms, R. A. Johnson, and R. K. Gibson Feb. 1982 65 p refs Sponsored in cooperation with DOE
(Contract DEN3-168)
(NASA-CR-167875; DOE/NASA/0168-82/4; DDA-EDR-10977; NAS 1.26:167875; SAR-4) Avail: NTIS HC A04/MF A01 CSCL 13I

Technical work on the design and component testing of a 74.5 kW (100 hp) advanced automotive gas turbine is described. Selected component ceramic component design, and procurement were tested. Compressor tests of a modified rotor showed high speed performance improvement over previous rotor designs; efficiency improved by 2.5%, corrected flow by 4.6%, and pressure ratio by 11.6% at 100% speed. The aerodynamic design is completed for both the gasifier and power turbines. Ceramic (silicon carbide) gasifier rotors were spin tested to failure. Improving strengths is indicated by burst speeds and the group of five rotors failed at speeds between 104% and 116% of engine rated speed. The emission results from combustor testing showed NOx levels to be nearly one order of magnitude lower than with previous designs. A one piece ceramic exhaust duct/regenerator seal platform is designed with acceptable low stress levels. E.A.K.

N83-15628*# IMA Resources, Washington, D.C.
DESIGN AND FEASIBILITY STUDY FOR A PORTABLE OIL RECOVERY TURBOPUMP Final Report
30 May 1982 65 p refs
(Contract NAS8-34538)
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A portable oil recovery turbopump concept, using the Firefly module as primer mover, for the offloading of distressed tank vessels is examined. The demands to be met both in terms of the type of petroleum to be offloaded, as well as the operational requirements placed on the pump, are studied with respect to the capability of different pump configurations. Two configurations, one a centrifugal type and the other a screw type pump, are developed and evaluated. While the centrifugal configuration is found to be effective in a large proportion of tank vessel offloading situations, the screw type will be required where high viscosity cargoes are involved. The feasibility of the turbopump concept, with the Firefly module as prime mover, is established. Author

N83-15629*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROTORDYNAMIC INSTABILITY PROBLEMS IN HIGH-PERFORMANCE TURBOMACHINERY
Washington Dec. 1982 460 p refs Workshop held in College Station, Tex., 10-12 May 1982; sponsored by Texas A and M Univ. and the Army Research Office
(NASA-CP-2250; E-1287; NAS 1.55:2250) Avail: NTIS HC A20/MF A01 CSCL 13I

Rotor dynamic instability problems in high performance turbomachinery are reviewed. Mechanical instability mechanisms are discussed. Seal forces and working fluid forces in turbomachinery are discussed. Control of rotor instability is also investigated. For individual titles, see N83-15630 through N83-15657.

N83-15630*# Southwest Research Inst., San Antonio, Tex.
ROTORDYNAMIC INSTABILITY FIELD PROBLEMS
J. C. Wachel *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 1-19 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Vibration data obtained during several rotor instability investigations is presented to illustrate the effect of changes in system parameters on overall rotor stability. The data includes the effects of bearing and seal changes as well as those due to variations in speed and pressure ratio. Field Problems indicate that the stability of rotors is often highly sensitive to fairly minor variations in bearing and seal parameters. Measured field data is valuable in normalizing analytical computer models so that effective solutions can be obtained. Author

N83-15631*# Radian Corp., Austin, Tex.
FIELD EXPERIENCES WITH RUB INDUCED INSTABILITIES IN TURBOMACHINERY
David G. Goggin *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 20-32 refs Sponsored by Hartford Steam Boiler Inspection and Insurance Co. (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Rotordynamic instability problems are not uncommon in high speed industrial turbomachinery. One type of the many destabilizing forces that can occur is caused by a rub between the stationary and rotating parts. Descriptions are given of several cases of rub induced instabilities. Included in the descriptions are the conditions at onset, the whirl frequency and direction, and the steps taken to eliminate the problem. Author

N83-15632*# Failure Analysis Associates, Palo Alto, Calif.
ANALYSIS OF A TURBINE ROTOR CONTAINING A TRANSVERSE CRACK AT OAK CREEK UNIT 17
G. W. Rogers, C. A. Rau, Jr., J. J. Kottke (Wisconsin Electric Power Co., Milwaukee), and R. H. Menning (Wisconsin Electric Power Co., Milwaukee) *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 33-44 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Transient increases in one, two and three per revolution vibration characteristics of a low pressure steam turbine were observed during steam temperature reduction operations. Vibration and fracture mechanics analyses suggested the presence of a

transverse shaft crack which was eventually identified by ultrasonic inspection and confirmed by destructive sectioning. Signature analyses of vibration data recorded over a two-year period prior to crack identification are correlated with fatigue crack growth, which occurred intermittently during transient temperature decreases. The apparent increased response of the rotor to vibration is due to asymmetric stiffness changes introduced by the growing transverse crack. The vibration response is predicted to increase with increasing crack depths in excess of 10% of the shaft diameter. Fracture mechanics analyses predict that fatigue crack growth occurred during periods of steam temperature decrease, when high surface tensile stresses are present. These same transient thermal stresses are shown to have retarded and prevented subsequent fatigue crack growth during steady operation. Author

N83-15633*# GEC Power Engineering Ltd., Stafford (England).
ASPECTS OF COULOMB DAMPING IN ROTORS SUPPORTED ON HYDRODYNAMIC BEARINGS
P. G. Morton *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 45-57 ref (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The paper is concerned with the effect of friction in drive couplings on the non-sychronous whirling of a shaft. A simplified model is used to demonstrate the effect of large coupling misalignments on the stability of the system. It is concluded that provided these misalignments are large enough, the system becomes totally stable provided the shaft is supported on bearings exhibiting a viscous damping capacity. Author

N83-15634*# Ingersoll-Rand Co., Phillipsburg, N. J.
INSTABILITIES OF GEARED COUPLINGS: THEORY AND PRACTICE
R. Gordon Kirk, Roy E. Mondy, and Richard C. Murphy *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 58-80 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The use of couplings for high speed turbocompressors or pumps is essential to transmit power from the driver. Typical couplings are either of the lubricated gear or dry diaphragm type design. Gear couplings have been the standard design for many years and recent advances in power and speed requirements have pushed the standard design criteria to the limit. Recent test stand and field data on continuous lube gear type couplings have forced a closer examination of design tolerances and concepts to avoid operational instabilities. Two types of mechanical instabilities are reviewed in this paper: (1) entrapped fluid, and (2) gear mesh instability resulting in spacer throw-out onset. Test stand results of these types of instabilities and other directly related problems are presented together with criteria for proper coupling design to avoid these conditions. An additional test case discussed shows the importance of proper material selection and processing and what can happen to an otherwise good design. Author

N83-15635*# Technische Universitaet, Hanover (West Germany). Ist. fuer Mechanik.
SHAFT VIBRATIONS IN TURBOMACHINERY EXCITED BY CRACKS
Burkhard Grabowski *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 81-97 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

During the past years the dynamic behavior of rotors with cracks has been investigated mainly theoretically. This paper deals with the comparison of analytical and experimental results of the dynamics of a rotor with an artificial crack. The experimental results verify the crack model used in the analysis. They show the general possibility to determine a crack by extended vibration control. Author

N83-15636*# Rocketdyne, Canoga Park, Calif.
DETERMINATION OF BALL BEARING DYNAMIC STIFFNESS
R. F. Beatty and B. F. Rowan *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 98-104 refs (For primary document see N83-15629 06-37)
(Contract NAS8-27980)
Avail: NTIS HC A20/MF A01 CSCL 13I

The dynamic radial stiffness characteristics of rolling element bearings are currently determined by analytical methods that have not been experimentally verified. These bearing data are vital to rotating machinery design integrity because accurate critical speeds and rotor stability predictions are highly dependent on the bearing stiffness. A tester was designed capable of controlling the bearing axial preload, speed, and rotor unbalance. The rotor and support structures were constructed to permit critical speeds that are predominantly determined by a 57 mm test bearing. A curve of calculated critical speed versus stiffness was used to determine the actual bearing stiffness from the empirical data. The results of extensive testing are used to verify analytical predictions, increase confidence in existing bearing computer programs, and to serve as a data base for efforts to correct these programs. Author

N83-15637*# Hitachi Ltd., Tsuchiura (Japan). Mechanical Engineering Research Lab.
ROTOR VIBRATION CAUSED BY EXTERNAL EXCITATION AND RUB
Osami Matsushita, Michiyuki Takagi, Katsuaki Kikuchi, and Makio Kaga *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 105-129 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

For turbomachinery with low natural frequencies, considerations have been recently required for rotor vibrations caused by external forces except unbalance one, such as foundation motion, seismic wave, rub and so forth. Such a forced vibration is investigated analytically and experimentally in the present paper. Vibrations in a rotor-bearing system under a harmonic excitation are analyzed by the modal technique in the case of a linear system including gyroscopic effect. For a nonlinear system a new and powerful quasi-modal technique is developed and applied to the vibration caused by rub. Author

N83-15638*# Rocketdyne, Canoga Park, Calif.
LINEAR FORCE AND MOMENT EQUATIONS FOR AN ANNULAR SMOOTH SHAFT SEAL PERTURBED BOTH ANGULARLY AND LATERALLY
J. Fenwick, R. DiJulio, M. C. Ek, and R. Ehrgott *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 130-146 refs Prepared in cooperation with California State Univ., Northridge (For primary document see N83-15629 06-37)
(Contract NAS8-27980)
Avail: NTIS HC A20/MF A01 CSCL 13I

Coefficients are derived for equations expressing the lateral force and pitching moments associated with both planar translation and angular perturbations from a nominally centered rotating shaft with respect to a stationary seal. The coefficients for the lowest order and first derivative terms emerge as being significant and are of approximately the same order of magnitude as the fundamental coefficients derived by means of Black's equations. Second derivative, shear perturbation, and entrance coefficient variation effects are adjudged to be small. Author

N83-15639*# Akron Univ., Ohio.
MEASUREMENT OF INTERSTAGE FLUID-ANNULUS DYNAMICAL PROPERTIES
M. L. Adams, E. Makay (Energy Research and Consultants Corp.), and I. A. Diaz-Tous (EPRI) *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 147-156 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The work described in this paper is part of an Electric Power

Research Institute sponsored effort to improve rotor vibrational performance on power plant feed water pumps. A major objective of this effort is to reduce vibration levels by devising inter-stage sealing configurations with optimized damping capacity, realizing that the typical multi-stage centrifugal pump has several ore inter-stage fluid annuli than it has journal bearings. Also, the fluid annuli are distributed between the journal bearings where vibration levels are highest and can therefore be 'exercised' more as dampers than can the bearings. Described in this paper is a test apparatus which has been built to experimentally determine fluid-annulus dynamical coefficients for various configurations of inter-stage sealing geometry. Author

N83-15640*# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.
TESTING OF TURBULENT SEALS FOR ROTORDYNAMIC COEFFICIENTS
Dara W. Childs and John B. Dressman (Louisville Univ., Ky.) *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 157-171 refs (For primary document see N83-15629 06-37)
(Contract NsG-3200)
Avail: NTIS HC A20/MF A01 CSCL 13I

A facility has been developed for dynamic testing of straight and convergent tapered seals with the capability of measuring the radial and tangential force components which result from a circular centered orbit. The test apparatus causes the seal journal to execute small-eccentricity centered circular orbits within its clearance circle. Dynamic measurements are made and recorded of the seal displacement-vector components, and of the pressure field. The pressure field is integrated to yield seal tangential and radial reaction-force components. Representative test data are provided and discussed for straight seals. Author

N83-15641*# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.
A HIGH-REYNOLDS-NUMBER SEAL TEST FACILITY: FACILITY DESCRIPTION AND PRELIMINARY TEST DATA
Dara W. Childs, Clayton Nelson, Ted Noyes, and John B. Dressman (Louisville Univ., Ky.) *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 172-186 refs (For primary document see N83-15629 06-37)
(Contract NAS8-33176)
Avail: NTIS HC A20/MF A01 CSCL 13I

A facility has been developed for testing the leakage and rotordynamic characteristics of interstage-seal configurations for the HPFTP (High Pressure Fuel Turbopump) of the SSME (Space Shuttle Main Engine). Axial Reynolds numbers on the order of 400,000 are realized in the test facility by using a Dupont freon fluid called Halon (CBrF3). The kinematic viscosity of Halon is of the same order as the liquid hydrogen used in the HPFTP. Initial testing has focused on the current flight configurations (a three-segment, stepped unit) and a convergent-taper candidate. Author

N83-15642*# Allis-Chalmers Mfg. Co., Milwaukee, Wis. Compressor and Custom Pump Div.
VIBRATION AND DESTABILIZING EFFECTS OF FLOATING RING SEALS IN COMPRESSORS
Mark F. Emerick *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 187-204 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Operating experience on a compressor commissioned 12 years ago has presented an interesting history of sporadic increases in shaft vibration. Initial operation was satisfactory with low levels of vibration. However, after some time the shaft vibration level increased to several mils. Initially this was believed to be due to rotor unbalance from deposits formed in the passages due to process upsets. After cleaning up the rotor, operation was again increased. It was then found that the rotor vibration was primarily subsynchronous. Further investigation revealed that the original seal design was subject to wear and was no longer properly pressure balanced. A modified seal design was installed and it has operated successfully for the past six years. Author

N83-15643*# Kobe Univ. (Japan). Faculty of Engineering.
FLOW INDUCED FORCE OF LABYRINTH SEAL
Takuzo Iwatsubo, Naoto Motooka, and Roji Kawai *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Tubomachinery Dec. 1982 p 205-222 ref (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Flow induced instability force due to a labyrinth seal is analyzed. An approximate solution is given for the partial differential equation representing the flow in labyrinth seal and it is compared with the finite difference method in order to verify the accuracy of both methods. The effects of difference of inlet and outlet pressures of the seal, deflection of pressure and mass flow from the steady state, rotor diameter, seal clearance, seal interval and seal number on the flow induced force of the seal are investigated and it is known that some of these factors are very influential on the flow induced force. Author

N83-15644*# Heriott-Watt Univ., Edinburgh (Scotland).
CIRCUMFERENTIAL PRESSURE DISTRIBUTIONS IN A MODEL LABYRINTH SEAL
Y. M. M. S. Leong and R. D. Brown *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Dec. 1982 p 223-241 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

A research program to isolate and study leakage flow through labyrinth glands was initiated. Circumferential pressure distributions were measured in the labyrinth glands with geometry appropriate to the high pressure labyrinths in large steam turbines. Knowledge of this pressure distribution is essential as it is this unequal pressure field that results in the destabilizing force. Parameters that are likely to affect the pressure distributions are incorporated into the test rig. Some preliminary pressure profiles are presented. Author

N83-15645*# Technische Universitaet, Munich (West Germany). Inst. fuer Thermische Kraftanlagen.
MEASUREMENT AND EVALUATION OF SWIRL-TYPE FLOW IN LABYRINTH SEALS OF CONVENTIONAL TURBINE STAGES
L. Hauck *In* NASA. Lewis Research Center Rotordyn. Intability Probl. in High-Performance Turbomachinery Dec. 1982 p 242-259 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The effects of load factor and rotor eccentricity were determined on flow conditions in test series for two stages. The results indicate that swirl-type entry flow follows the rules of potential swirl. Within the labyrinth cavities two spatial separated flow areas are considered. A dominating flow in periphera direction nearly fills the space between the sealing strips and the ceiling of the cavity. Below this flow, an area of axial mass transport is situated, with a slight peripheral component, limited on the nearest surroundings of the seals gap and the rotor surface. Between both flows, an exchange of energy takes place. Within the gaps, flow direction depends on axial velocity and therefore on variable flow contraction. A balance of energy within the seal and the cavities interprets the results of lateral force measurements as an influence of friction at the sealing strips surface and the rotating shaft surface. Stages with their blades put together in buckets by means of shrouding segments are particularly influenced by the rotating speed of the shrouding. Author

N83-15646*# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.
EXPERIMENT MEASUREMENT OF ALFORD'S FORCE IN AXIAL-FLOW TURBOMACHINERY
John M. Vance and Frank J. Laudadio (Motorola Corp., Fort Lauderdale, Fla.) *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 260-273 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Results of experimental measurements made on a small high

speed, axial flow test apparatus are presented to verify the existence of Alford's force (that circumferential variation of blade-tip clearances in axial-flow turbomachinery will produce cross-coupled (normal to the eccentricity) aerodynamic forces on the rotor) and to investigate the validity of his mathematical prediction model. Author

N83-15647*# Massachusetts Inst. of Tech., Cambridge.
HEURISTIC EXPLANATION OF JOURNAL BEARING INSTABILITY
Stephen H. Crandall *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 274-283 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

A fluid-filled journal bearing is viewed as a powerful pump circulating fluid around the annular space between the journal and the bearing. A small whirling motion of the journal generates a wave of thickness variation progressing around the channel. The hypothesis that the fluid flow drives the whirl whenever the mean of the pumped fluid velocity is greater than the peripheral speed of the thickness variation wave is discussed and compared with other simple explanations of journal bearing instability. It is shown that for non-cavitation long bearings the hypothesis predicts instability onset correctly for unloaded bearings but gradually overpredicts the onset speed as the load is increased. Author

N83-15648*# Kaiserslautern Univ. (West Germany). Dept. of Mechanical Engineering.
INFLUENCE OF PARAMETER CHANGES TO STABILITY BEHAVIOR OF ROTORS
Claus P. Fritzen and Rainer Nordmann *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 284-306 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The occurrence of unstable vibrations in rotating machinery requires corrective measures for improvement of the stability behavior. A simple approximate method is represented to find out the influence of parameter changes to the stability behavior. The method is based on an expansion of the eigenvalues in terms of system parameters. Influence coefficients show the effect of structural modifications. The method first of all was applied to simple nonconservative rotor models. It was approved for an unsymmetric rotor of a test rig. Author

N83-15649*# Bently Nevada Corp., Minden.
STABILITY EVALUATION OF ROTOR/BEARING SYSTEM
Donald E. Bently and Angieszka Muszynska *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 307-322 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

A stability study of rotor/bearing systems is presented. Even though it was limited to study of a fully lubricated bearing subject to oil whirl, and further limited to low eccentricity region for linearity and with only one type of lubricant, it can be seen that the perturbation methodology, together with the sorting of the impedance terms into direct and quadrature with respect to input force can be very useful to the general study of stability. Further, the concept of active feedback should assist to increase knowledge in rotor system stability. While there remains a large amount of study to be accomplished, perhaps some more tools are available to assist this field of analysis. Author

N83-15650*# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
AERODYNAMIC STIFFNESS OF AN UNBOUND ECCENTRIC WHIRLING CENTRIFUGAL IMPELLER WITH AN INFINITE NUMBER OF BLADES
Paul E. Allaire, Lyle A. Branagan (Pacific Gas and Electric Co., San Ramon, Calif.), and John A. Kocur *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 323-343 refs (For primary document see N83-15629 06-37)
(Grant NAG3-180)
Avail: NTIS HC A20/MF A01 CSCL 13I

An unbounded eccentric centrifugal impeller with an infinite number of log spiral blades undergoing synchronous whirling in an incompressible fluid is considered. The forces acting on it due to coriolis forces, centripetal forces, changes in linear momentum, changes in pressure due to rotating and changes in pressure due to changes in linear momentum are evaluated. Author

N83-15651*# Nuovo Pignone S.p.A., Florence (Italy).
UNSTEADY FLOW PHENOMENA IN INDUSTRIAL CENTRIFUGAL COMPRESSOR STAGE
L. Bonciani, L. Terrinoni, and A. Tesei *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 344-364 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

The results of an experimental investigation on a typical centrifugal compressor stage running on an atmospheric pressure test rig are shown. Unsteady flow was invariably observed at low flow well before surge. In order to determine the influence of the statoric components, the same impeller was repeatedly tested with the same vaneless diffuser, but varying return channel geometry. Experimental results show the strong effect exerted by the return channel, both on onset and on the behavior of unsteady flow. Observed phenomena have been found to confirm well the observed dynamic behavior of full load tested machines when gas density is high enough to cause appreciable mechanical vibrations. Therefore, testing of single stages at atmospheric pressure may provide a fairly accurate prediction of this kind of aerodynamic excitation. Author

N83-15652*# State Univ. of Gent (Belgium).
COMPARATIVE STUDY OF SUBSYNCHRONOUS ROTATING FLOW PATTERNS IN CENTRIFUGAL COMPRESSORS WITH VANELESS DIFFUSERS
P. Frigne and R. VanDenBraembussche (Von Karman Inst. for Fluid Dynamics) *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 365-381 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

A comparative experimental investigation of the unstable operating modes of a centrifugal compressor was made. Impeller and/or diffuser rotating stall was observed, depending on the flow conditions. The measured relative rotational speed of this perturbation is cross checked with other experimental data and it is shown that the rotational speed is strongly dependent on the type of rotating stall. The diffuser absolute inlet flow angle at the onset of diffuser rotating stall agrees well with the value predicted by an existing stability criterion. Author

N83-15653*# California Inst. of Tech., Pasadena.
EXPERIMENTAL MEASUREMENTS OF HYDRODYNAMIC STIFFNESS MATRICES FOR A CENTRIFUGAL PUMP IMPELLER
D. S. Chamieh, A. J. Acosta, C. E. Brennen, T. K. Caughey, and R. Franz *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 382-398 refs (For primary document see N83-15629 06-37)
(Contract NAS8-33108)
Avail: NTIS HC A20/MF A01 CSCL 13I

The objective of the Rotor Force Test Facility at the California Institute of Technology is to artificially orbit the center of rotation of an impeller enclosed within a volute over a range of frequencies from zero to synchronous and to measure the resulting forces on the impeller. Preliminary data from the first stage experiments in which the shaft is orbited at low frequency is reported. Steady volute forces along with stiffness matrices due to the change in position of the rotor center are measured. Static pressure taps around the volute are used to obtain volute pressure distributions for various fixed positions of the impeller center and for various flow rates. Static pressure forces are calculated from these pressure distributions allowing a more complete analysis of the

components of the impeller forces. Comparison is made with various existing theoretical and experimental results. Author

N83-15654*# Detroit Diesel Allison, Indianapolis, Ind.
GAS TURBINE ROTOR/CASE STRUCTURAL RESPONSE TO ROTATING STALL: EXPERIMENTAL DOCUMENTATION AND ANALYTICAL APPROACH
Philip J. Haley *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 399-414 (For primary document see N83-15629 06-37)
(Contract F33615-79-C-2089)
Avail: NTIS HC A20/MF A01 CSCL 13I

The forcing functions and structural responses characterizing gas turbine rotor/case system vibration due to rotating stall in an axial flow compressor are described. Two data sets with fundamentally different response characteristics are presented; one is supersynchronous and the other subsynchronous. Conventional beam element rotor dynamics analysis is shown to be severely limited in its ability to predict these responses. A new analytical approach, which significantly increases structural response predictive capability for these phenomena, is briefly discussed. Author

N83-15655*# Sussex Univ., Brighton (England).
INVESTIGATION OF SQUEEZE-FILM DAMPERS
R. Holmes and M. Dogan *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 415-433 refs Sponsored by Rolls Royce Ltd. (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Squeeze film dampers are a means of curing instabilities in rotating shaft assemblies. Their efficiency depends very much on the condition of the oil, which in turn depends on inlet and outlet arrangements, on damper geometry and on the flexibility of the rotor and surrounding structure. Rig investigations in which structural flexibility is included experimentally are discussed. Comparisons are made between measured and predicted results. Author

N83-15656*# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
VIBRATION LIMITING OF ROTORS BY FEEDBACK CONTROL
David W. Lewis, James W. Moore, Philip L. Bradley, and Paul E. Allaire *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 434-439 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Experimental findings of a three mass rotor with four channels of feedback control are reported. The channels are independently controllable with force being proportional to the velocity and/or instantaneous displacement from equilibrium of the shaft at the noncontacting probe locations (arranged in the vertical and horizontal attitudes near the support bearings). The findings suggest that automatic feedback control of rotors is feasible for limiting certain vibration levels. Control of one end of a rotor does afford some predictable vibration limiting of the rotor at the other end. Author

N83-15657*# Mechanical Technology, Inc., Latham, N. Y.
EVALUATION OF SHEAR MOUNTED ELASTOMERIC DAMPER
E. Zorzi and J. Walton *In* NASA. Lewis Research Center Rotordyn. Instability Probl. in High-Performance Turbomachinery Dec. 1982 p 440-452 refs (For primary document see N83-15629 06-37)
Avail: NTIS HC A20/MF A01 CSCL 13I

Viton-70 elastomeric shear mounted damper was built and tested on a T-55 power turbine spool in the rotor's high speed balancing rig. This application of a shear mounted elastomeric damper demonstrated for the first time, the feasibility of using elastomers as the primary rotor damping source in production turbine engine hardware. The shear damper design was selected because it was compatible with actual gas turbine engine radial space constraints, could accommodate both the radial and axial thrust loads present in gas turbine engines, and was capable of controlled axial preload. The shear damper was interchangeable with the production T-55 power turbine roller bearing support so that a direct comparison between the shear damper and the production support structure could be made. Test results show that the Viton-70 elastomer damper operated successfully and provided excellent control of both synchronous and nonsynchronous vibrations through all phases of testing up to the maximum rotor speed of 16,000 rpm. Excellent correlation between the predicted and experienced critical speeds, mode shapes and log decrements for the power turbine rotor and elastomer damper assembly was also achieved. Author

N83-15658*# Detroit Diesel Allison, Indianapolis, Ind.
ADVANCED GAS TURBINE (AGT) POWER-TRAIN SYSTEM Semiannual Report
H. E. Helms, R. A. Johnson, and R. K. Gibson Feb. 1982 65 p refs
(Contract DEN3-168)
(NASA-CR-167875; DOE/NASA/0168-82/4; NAS 1.26:167875; DDA-EDR-10977; SAR-4) Avail: NTIS HC A04/MF A01 CSCL 13I

The design and component testing of a 74.5 kW (100 hp) advanced automotive gas turbine is described. The design for an engine to be tested was finalized, and component testing, and ceramic component design, testing, and procurement were continued. Compressor tests of a modified rotor showed high speed performance improvement over previous rotor designs; efficiency improved by 2.5%, corrected flow by 4.6%, and pressure ratio by 11.6% at 100% speed. Aerodynamic design was completed for both the gasifier and power turbines. Ceramic (silicon carbide) gasifier rotors were spin tested to failure in a continuing series of tests. Results show improving strengths as indicated by burst speeds, and the latest group of five rotors failed at speeds between 104% of engine rated speed. The emission results from combustor testing showed NOx levels to be nearly one order of magnitude lower than with previous designs. A one piece ceramic exhaust duct/regenerator seal platform was designed with acceptably low stress levels. A control system for the first engine run was designed, and fabrication of some elements began. S.L.

N83-15659*# Crane Packing Co., Morton Grove, Ill.
ENERGY EFFICIENT FACE SEAL
J. Sehnal, J. Sedy, I. Etsion, and A. Zobens 11 Feb. 1982 113 p refs
(Contract NAS3-22128)
(NASA-CR-165591; NAS 1.26:165591) Avail: NTIS HC A06/MF A01 CSCL 11A

Torque, face temperature, leakage, and wear of a flat face seal were compared with three coned face seals at pressures up to 2758 kPa and speeds up to 8000 rpm. Axial movement of the mating seal parts was recorded by a digital data acquisition system. The coning of the tungsten carbide primary ring ranged from .51 micro-m to 5.6 micro-m. The torque of the coned face seal balanced to 76.3% was an average 42% lower, the leakage eleven times higher, than that of the standard flat face seal. The reduction of the balance of the coned face seal to 51.3% resulted by decreasing the torque by an additional 44% and increasing leakage 12 to 230 times, depending on the seal shaft speed. No measurable wear was observed on the face of the coned seals. E.A.K.

N83-15660# Area Therm Corp., Springfield, Va.
THERMAL SUPPRESSION OF EXHAUST PIPES Final Report, Feb. - Aug. 1982
Edward F. Allard Sep. 1982 31 p
(Contract DAAK70-82-C-0040; DA Proj. 1L1-62733-AH-20-EE)
(AD-A119455; ATC-55) Avail: NTIS HC A03/MF A01 CSCL 10/2

An air ejector was used for thermal suppression applications. The results show that an engine's exhaust pipe with a temperature near 400 C can be effectively reduced to a temperature near 50 C. This is a temperature reduction of 350 C. This was achieved with a single pipe and a nozzle on the engine's exhaust pipe. A simplified theory, developed for this program, was a guide to design.

Utilizing known data from the technical literature on certain sections of the design, an air ejector was designed, built and tested. Entrainment ratios were measured for this ejector using 0.5 in and 0.75 in nozzles. The flow through the nozzles was measured by an air manifold system. Ambient air, heated air and exhaust gases were forced through the nozzles, and entrainment ratios were measured for these driving fluids. GRA

N83-15661# Goodyear Aerospace Corp., Akron, Ohio. Engineered Fabrics Div.
DEVELOPMENT OF A 40,000 GALLON HIGH PROFILE, COLLAPSIBLE, RUBBERIZED FABRIC, FUEL STORAGE TANK Final Report, 12 May 1981 - 15 Oct. 1982
R. L. Sosnowski 1982 76 p refs
(Contract DAAK70-81-C-0056)
(AD-A120733; GAC-19-1536) Avail: NTIS HC A05/MF A01 CSCL 13/4

This report describes the development and testing of an experimental 40,000 gallon collapsible, rubberized fabric, high-profile, petroleum fuel storage tank. The objective of the project was to develop a tank having a 40,000 gallon capacity which would occupy approximately the same ground area as a standard 20,000 gallon tank and meet the performance requirements of MIL-ST-82123. The tank was developed based upon a military adaptation of a commercial item (MACI) study following which a prototype unit was fabricated and tested. The prototype tank assembly completed the functional testing without leakage but fitting collars were observed to lift during the stand test and overload test. A stress concentration was also seen to exist between the fill/discharge fittings and the body seams caused by the closeness of the fittings to the seams. The integrity of the tank was not affected by these conditions. During the overload test it was noticed that an approximate 2' long area of one end seam showed excessive elongation on the seam edge gum strip. The fitting collars and end seam were repaired prior to delivery of the tank to the Army. All material tests were passed. GRA

N83-15662# Ohio State Univ., Columbus. Dept. of Welding Engineering.
DEVELOPMENT OF LOW COST FILLER MATERIALS FOR WELDING HIGH STRENGTH STEELS Annual Report, 1 Sep. 1981 - 31 Aug. 1982
David G. Howden 2 Sep. 1982 9 p
(Contract N00014-81-K-0788)
(AD-A120641) Avail: NTIS HC A02/MF A01 CSCL 13/8

In the GMAW system, equipment was built to feed a second wire into the leading edge of the pool. Commercial welding wires were selected and used to produce the required composition with good homogeneity in the weld metal. In the SMAW system two approaches were investigated to produce weld metal of target composition by alloying two wires rather than by relying on alloying elements contained in the coating of the rod (as per commercial practice). Electrodes made from a tube with an alloy wire inside and others made from a solid rod with a ribbon of alloy material tacked to the outside both showed excellent welding characteristics with homogenous weld metal compositions. GRA

N83-15663# Los Alamos Scientific Lab., N. Mex.
ANTARES ALIGNMENT GIMBAL POSITIONER LINEAR BEARING TESTS
R. D. Day, D. D. Pierce, and R. E. Lujan 1981 6 p Presented at the 7th Conf. on Appl. Mech., Kansas City, Mo., 7 Dec. 1981
(Contract W-7405-eng-36)
(DE82-000758; LA-UR-81-2873; CONF-811209) Avail: NTIS HC A02/MF A01

Solid circular rails with either the wet or dry lubricant are superior to the other configuration tested. Therefore, these will undergo additional tests. They consist of (1) modifying the testing procedure to obtain a better estimation of the limits of precision; and (2) subjecting the bearings to moments more closely approximating the actual conditions they will undergo on the alignment gimbal positioner. DOE

N83-15664# Atomic Energy Research Establishment, Harwell (England). Nuclear Physics Div.
A STUDY OF DISC WEAR ON A PIN-ON-DISC TESTER BY THIN LAYER ACTIVATION
J. Asher and A. T. Peacock Apr. 1982 19 p refs
(AERE-R-10524) Avail: NTIS HC A02/MF A01

The wear rate of an iron disc in lubricated contact with an iron pin on a pin-on-disc wear tester was measured using thin layer activation. The ratio of disc wear to pin wear was shown to be lower than that predicted on the basis of equal volumetric wear and, under one set of conditions, to have systematic correlations with the conditions of load and sliding speed. A temperature dependent mechanism is proposed to explain the phenomena observed. M.G.

N83-15665# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.
VACUUM BRAZING STUDIES
B. McGurran, E. N. Hodkin, and M. G. Nicholas Jun. 1982 34 p refs
(AERE-R-10566) Avail: NTIS HC A03/MF A01

A study is being undertaken to identify factors that control wetting and spreading during vacuum brazing. The initial program concentrated on the behavior of aluminium workpieces contacted by the low melting point metals gallium, indium and tin, which are employed as model braze alloys. Results obtained so far indicate that wetting occurs by the liquid metals penetrating the surface oxide films and speading along the interface between them and the aluminium substrate. Rivulet networks are formed and these extend from grain boundaries in advance of the main body of the wetted drops. Most effects of wetting were deduced from post mortem studies of solidified samples using optical and scanning electron microscopy. However, a technique was developed in which an SEM equipped with a hot stage can be used to observe directly the flow of liquid metal over workpiece surfaces. Since the working vacuum of an SEM is comparable to those industrial vacuum furnaces, the technique lends itself readily to vacuum brazing studies. Author

N83-15258# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELF-EXCITED RESONANCE OF AEROSTATIC BEARINGS IN A VACUUM ENVIRONMENT
Fu Xianluo (Academia Sinica) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 143-160 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

N83-15505# Anderson (William J.), North Olmsted, Ohio.
BEARINGS: TECHNOLOGY AND NEEDS
William J. Anderson *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 16 p refs Previously announced as N82-26679 (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15507# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.
INCREASING THE WEAR LIFE OF GAS TURBINE ENGINE ROLLER BEARINGS
P. F. Brown, L. J. Dobek, M. J. Carrano, R. A. Valori (Naval Air Propulsion Center, Trenton), and R. D. Dayton (AFWAL) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 14 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15509# Tribology Consultants, Inc., Paoli, Pa.
SILICON NITRIDE BEARING ELEMENTS FOR HIGH-SPEED HIGH-TEMPERATURE APPLICATIONS
Lewis B. Sibley *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 12 p refs Sponsored in part by Naval Air Systems Command, the Dept. of Army, Norton Co., Solar International and SKF Industries, Inc. (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15510# SKF Engineering and Research Centre, Nieuwegein (Netherlands). Material Development Dept.
LIGHTWEIGHT MATERIALS FOR ROLLING ELEMENTS IN AIRCRAFT BEARINGS
R. T. Cundill and F. Giordano (RIV-SKF Industrie S.p.A.) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 10 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15512*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LUBRICATION OF 35-MILLIMETER-BORE BALL BEARINGS OF SEVERAL DESIGNS AT SPEEDS TO 2.5 MILLION DN
Hans R. Signer (Industrial Tectonics, Inc.) and Frederick T. Schuller *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 15 p refs (For primary document see N83-15504 06-31)
(Contract NAS3-19779)
Avail: NTIS HC A20/MF A01 CSCL 13I

N83-15513# Cranfield Inst. of Tech., Bedfordshire (England). School of Mechanical Engineering.
MITIGATION OF THERMAL HAZARDS IN ROLLING CONTACT BEARINGS THROUGH CORRELATED COMPUTER ANALYSIS
V. A. Schwarz and B. R. Reason *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 15 p refs Sponsored in part by Escola Federal de Engenharia de Itajuba and CAPES (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15514*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELASTOHYDRODYNAMIC LUBRICATION OF ELLIPTICAL CONTACTS
Bernard J. Hamrock *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 14 p refs Presented at the 1st Symp. INTERTRIBO, Stvbske Pleso Czechoslovakia, 27-29 Apr. 1981 (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15515# Institut National des Sciences Appliquees de Lyon, Villeurbanne (France). Lab. de Mecanique des Contacts.
FILM THICKNESS AND FRICTION ON ENERGY IN THE ELASTOHYDRODYNAMIC REGIME IN THE CONTACT OF A BALL AND THE PATH OF A ROLLING DISK [EPAISSEUR DU FILM ET FORCE DE FROTTEMENT EN REGIME ELASTOHYDRODYNAMIQUE DANS LE CONTACT BILLE-CHEMIN DE BAGUE D'UN ROULEMENT]
Gerard Dalmaz and Nabil Gadallah *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 12 p refs In FRENCH Sponsored in part by Direction des Recherches et Moyens d'Essais (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15516# Leeds Univ. (England). Dept. of Mechanical Engineering.
THE LUBRICATION OF RIGID ELLIPSOIDS BY A PIEZO-VISCOUS FLUID
D. Dowson, J. F. Dunn, and C. M. Taylor *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 5 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15517# Timken Co., Canton, Ohio.
REGIMES OF FLUID FLIM LUBRICATION AT THE RIB-ROLLER CONTACT IN A TAPERED ROLLER BEARING
C. L. Swingler *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 10 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15518# State Univ. of Gent (Belgium). Lab. of Machines and Machine Construction.
THE INFLUENCE OF THE SHEAR THINNING EFFECTS OF NON-NEWTONIAN OILS ON THE PERFORMANCE OF FINITE LENGTH JOURNAL BEARINGS
M. Vermeulen and H. S. Yoo (INHA Univ., Incheon, Korea) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 15 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15519# Institut National des Sciences Appliquees de Lyon, Villeurbanne (France). Lab. de Mecanique des Contacts.
SLIDING IN THE WORKING OF A ROLLER BEARING: THE INFLUENCE OF THE LUBRICANT [GLISSEMENT DANS LES ROULEMENTS A ROULEAUX INFLUENCE DU LUBRIFIANT]
Daniel Berthe and Louis Flamand *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 9 p refs In FRENCH Sponsored in part by DRET (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15520*# Missouri Univ., Rolla. Dept. of Mechanical and Aerospace Engineering.
A DETAILED TREATMENT OF TWO-DIMENSIONAL, STARVED LUBRICATION IN THE VICINITY OF TWO COUNTER-ROTATING CYLINDERS
Robert A. Medrow and Larry R. Shipers *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 10 p (For primary document see N83-15504 06-31)
(Grant NsG-3113)
Avail: NTIS HC A20/MF A01 CSCL 13I

N83-15521# FAG Kugelfischer Georg Schaefer und Co., Schweinfurt (West Germany).
THE BEHAVIOR OF VARIOUS ROLLING BEARING MATERIALS UNDER UNFAVORABLE LUBRICATION CONDITIONS
Hans Karl Loroesch, Peter Dreschmann, and Rudolf Weigand *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 9 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15522*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GEOMETRY AND STARVATION EFFECTS IN HYDRODYNAMIC LUBRICATION
David Brewe (AVRADCOM) and Bernard J. Hamrock *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 12 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15523*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LUBRICANT EFFECTS ON EFFICIENCY OF A HELICOPTER TRANSMISSION
Andrew M. Mitchell and John J. Coy (AVRADCOM) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 14 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01 CSCL 11H

N83-15524# Pisa Univ. (Italy). Dipartimento di Costruzioni Meccaniche e Nucleari.
THE DYNAMIC PERFORMANCE OF THE SELF-REGULATED HYDROSTATIC OPPOSED-PAD BEARING
R. Bassani and B. Piccigallo (Accademia Navale) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 12 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15525# Poitiers Univ. (France). Lab. de Mecanique des Solides.
DYNAMIC BEHAVIOR OF A SMOOTH BEARING: STABILITY CRITERIA [COMPRTEMENT DYNAMICE D'UN PALIER LISSE CRITERES DE STABILITE]
J. Frene, D. Nicolas, and N. Abdul Wahed *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 10 p refs In FRENCH Prepared in cooperation with Institut National Sciences des Appliquees de Lyon, Villeurbanne (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15526# Cranfield Inst. of Tech., Bedfordshire (England). School of Mechanical Engineering.
THE COMPUTER AIDED DESIGN ENTITY (CADE): A NEW APPROACH TO JOURNAL BEARING DESIGN
A. H. Siew and B. R. Reason *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 12 p refs Sponsored in part UK Sciences Research Council (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15527# Middle East Technical Univ., Ankara (Turkey). Dept. of Mechanical Engineering.
AN EXPERIMENTAL METHOD FOR THE DETERMINATION OF JOURNAL BEARING COEFFICIENTS
M. Akkoek *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 12 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15528# Technical Univ. of Denmark, Lyngby. Dept. of Machine Elements.
AN ANALYTICAL STUDY OF THE HEAT BALANCE FOR A JOURNAL BEARING
P. K. Hansen (Det Norske Veritas) and J. W. Lund *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 9 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15529# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Technische Physik.
BEHAVIOR OF AIRCRAFT ENGINE OILS AT HIGH TEMPERATURE
E. Jantzen *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 11 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15530*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL AND ANALYTICAL DETERMINATION OF GEAR TOOTH TEMPERATURES WITH OIL JET LUBRICATION
Dennis P. Townsend and Lee S. Akin (Western Gear Corp.) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 14 p refs Presented at the ASME 3rd Intern. Power Transmission and Gearing Conf., San Francisco, 18-22 Aug. 1980 (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15531# Franklin Research Center, Philadelphia, Pa.
AN ADVANCED METHOD FOR PREDICTING HYBRID BEARING PERFORMANCE
R. Colsher, I. Anwar, and S. Katsumata *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 12 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15532# Universite de Technologie de Compiegne (France). Div. Electromecanique.
THEORETICAL AND EXPERIMENTAL STUDY OF AN AXIAL MAGNETIC BEARING OF THE ACTIVE TYPE [ETUDE THEORIQUE ET EXPERIMENTALE D'UN PALIER MAGNETIQUE AXIAL DU TYPE ACTIF]
Michel Kant and Roger Kessou *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 6 p refs In FRENCH (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15533# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Dept. Chemin.
THE ACTIDYNE ACTIVE MAGNETIC BEARING [LE PALIER MAGNETIQUE ACTIF ACTIDYNE]
Helmut Habermann *In its* Probl. in Bearings and Lubrication Aug. 1982 9 p refs In FRENCH (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15534# Sussex Univ., Brighton (England).
AN INVESTIGATION OF SQUEEZE-FILM DAMPERS IN FLEXIBLE SUPPORT STRUCTURES
R. Holmes and M. Dogan *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 9 p refs Sponsored in part by Rolls Royce (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15535# CEMUL, Lisbon (Portugal).
SQUEEZE-FILM BEARING SUPPORT ANALYSIS
F. A. P. DaSilva *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 8 p refs Sponsored in part by UK Sciences Research Council (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15536# Cranfield Inst. of Tech., Bedfordshire (England). School of Mechanical Engineering.
UNCENTRALIZED SQUEEZE-FILM DAMPER BEARINGS APPLIED TO AN OVERHUNG DISC/ROTOR SYSTEM
R. A. Cookson and Xin-Hai Feng (Chinese Aeronautical Establishment) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 13 p refs Sponsored in part by UK Sciences and Engineering Research Council (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15537# Karlsruhe Univ. (West Germany). Inst. fuer Maschinenkonstruktionslehre.
AERODYNAMIC COMPLIANT BEARINGS FOR SMALL TURBOENGINES
M. Ehinger, J. Glienicke, and H. Hunger *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 13 p refs Sponsored in part by Bundesministerium fuer Wirtschaft (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15538# Garrett Turbine Engine Co., Phoenix, Ariz.
HIGH-TEMPERATURE (649 DEG C/1200 DEG F) COATINGS FOR GAS-LUBRICATED FOIL BEARINGS OF THE NAVY'S ADVANCED AUXILIARY POWER UNIT CONCEPTS
Frank J. Suriano, Robert J. Keiser, Fred G. Woessner (Naval Air Propulsion Center, Trenton), and Ray Valori (Naval Air Propulsion Center, Trenton) *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 17 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15539# Middle East Technical Univ., Ankara (Turkey). Dept. of Mechanical Engineering.
EVALUATION OF ANTI STICK-SLIP BEHAVIOUR OF BRONZE FILLED PTFE AS BEARING MATERIAL
O. Anlagan *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 7 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15540# Pisa Univ. (Italy). Ist. di Macchine.
APPLICATION OF DYNAMIC GAS BEARINGS TO CRYOGENIC COMPRESSORS AND TURBINES
G. Nardi *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 7 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N83-15666# California Univ., Berkeley. Operations Research Center.

SOME RELIABILITY APPLICATIONS OF THE VARIABILITY ORDERING
Sheldon M. Ross and Zvi Schechner May 1982 22 p refs
(Grant AF-AFOSR-0122-81; AF Proj. 2304)
(AD-A120815; ORC-82-6) Avail: NTIS HC A02/MF A01 CSCL 12/2

The random variable X is said to be more variable than Y if E(f(x)) = or > E(f(Y)) for all increasing convex functions f. We prove a preservation, under random sized sums, property of this ordering and then applying it to branching processes and shock models. Other applications of this order to a population survival and to a Poisson shock model are also given. Author (GRA)

N83-15667# Stanford Univ., Calif.
INSPECTION POLICIES FOR FAULT LOCATION
David A. Butler and Gerald J. Lieberman Aug. 1982 17 p refs Prepared in cooperation with Oregon State Univ., Corvallis
(Contracts N00014-75-C-0561; N00014-79-C-0751)
(AD-A120661; TR-206; TR-81) Avail: NTIS HC A02/MF A01 CSCL 14/4

When a system fails it may not be obvious which components are at fault. Locating faulty components to be replaced may require a series of inspections each of which reveals the state (functioning/failed) of one of the components. The order in which components are inspected and replaced can greatly affect the cost to restore the system to an operating condition. This paper investigates inspection sequences for complex coherent systems. GRA

N83-15668# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics Div.
ACOUSTIC EMISSION FOR NDE IN THE NUCLEAR INDUSTRY
C. B. Scruby and H. N. G. Wadley Jul. 1982 16 p refs
(AERE-R-10537) Copyright. Avail: Issuing Activity

Acoustic emission (AE) is emerging as a technique with a number of potentially important nuclear NDE applications. These include the monitoring of weld fabrication, shop, preservice and in service hydrotests of the reactor pressure vessel, together with in service continuous monitoring and leak detection. Experience to date has shown some success with most of these applications, but has also highlighted four areas for development. The reliability of AE must be established by understanding the relationship between detected amplitudes and materials and testing parameters. Methods for reducing or discriminating location in 3-D must be developed so that defect depth can be determined. Finally, research into source characterization must be accelerated and the results incorporated into practical testing so that flaws indicated by AE can be immediately assessed. S.L.

N83-15669# Atomic Energy Research Establishment, Harwell (England). Materials Physics Div.
HARWELL ULTRASONIC FLAW DETECTION AND SIZING EQUIPMENT WITH DIGITAL RECORDING
P. Carter and T. Slesenger Dec. 1981 27 p refs
(AERE-R-10386) Avail: NTIS HC A03/MF A01

An ultrasonic crack location and sizing technique was developed. It differs from conventional methods in that the crack tips themselves are located from the energy remitted by diffraction. A transportable development system for recording the ultrasonic waveforms digitally and for displaying the information on a video monitor and the various processing steps available are described. S.L.

N83-15506# Defence Research Establishment Pacific, Victoria (British Columbia).
DETECTION AND DIAGNOSIS OF BEARING DETERIORATION IN AIRCRAFT PROPULSION SYSTEMS BY WEAR DEBRIS ANALYSIS
C. A. Waggoner *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 13 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

N83-15508# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Mechanical Engineering.
CONDITION MONITORING OF BEARINGS: A MEASURING TECHNIQUE IN AN EXPERIMENTAL STAGE
M. J. W. Schouten *In* AGARD Probl. in Bearings and Lubrication Aug. 1982 9 p refs (For primary document see N83-15504 06-31)
Avail: NTIS HC A20/MF A01

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N83-15670# Conselho Nacional de Pesquisas, Rio de Janeiro (Brazil). Lab. de Computacao Cientifica
A LINEAR UNCOUPLING NUMERICAL SCHEME FOR THE NONLINEAR COUPLED THERMOELASTODYNAMICS EQUATIONS
Carlos A. deMoura Oct. 1982 11 p refs Submitted for publication
(Rept-012/82; ISSN-0101-6113) Avail: NTIS HC A02/MF A01

A numerical scheme for computing approximate solutions to the nonlinear equations of coupled thermoelastodynamics is proposed. The discretization is made in such a way that the algebraic system to be solved at each time level is a linear one, the displacement and temperature fields being uncoupled for the calculations. M.G.

N83-15671*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NONLINEAR AND TANGENT STIFFNESS OF IMPERFECT BEAM COLUMNS
Melvin S. Anderson Dec. 1982 28 p refs
(NASA-TM-84497; NAS 1.15:84497) Avail: NTIS HC A03/MF A01 CSCL 20K

A curved member under axial load is analyzed using beam column theory to determine nonlinear response and the tangent stiffness associated with small displacements from the nonlinear state. Such a result is suitable for incorporation into a general nonlinear analysis using a corotational coordinate system to describe the rigid body type motion of individual members. The method is applied to buckling problems. Several examples are given to show the accuracy of the method. S.L.

N83-15672*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF STRUCTURAL COUPLING ON MISTUNED CASCADE FLUTTER AND RESPONSE
Robert E. Kielb and Krishna Rao V. Kaza (Toledo Univ.) 1983 17 p refs Proposed for presentation at the 28th Ann. Intern. Gas Turbine Conf., Phoenix, Ariz., 27-31 Mar. 1983; sponsored by ASME
(NASA-TM-83049; E-1500; NAS 1.15:83049) Avail: NTIS HC A02/MF A01 CSCL 20K

The effects of structural coupling on mistuned cascade flutter and response are analytically investigated using an extended typical section model. This model includes both structural and aerodynamic coupling between the blades. The model assumes that the structurally coupled system natural modes were determined and are represented in the form of N bending and N torsional uncoupled modes for each blade, where N is the number of blades and, hence, is only valid for blade dominated motion. The aerodynamic loads are calculated by using two dimensional unsteady cascade theories in the subsonic and supersonic flow regimes. The results show that the addition of structural coupling can affect both the aeroelastic stability and frequency. The stability is significantly affected only when the system is mistuned. The resonant frequencies can be significantly changed by structural coupling in both

tuned and mistuned systems, however, the peak response is significantly affected only in the latter. S.L.

N83-15673# Commissariat a l'Energie Atomique, Gif-sur-Yvette (France). Dept. des Etudes Mecaniques et Termiques.
HOW TO OBTAIN J-R CURVE FROM ONE TEST ON ONE SAMPLE
R. Roche Jan. 1981 47 p refs In FRENCH; ENGLISH summary
(CEA-N-5084) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

Operational definition of J concept is first examined. Then it is shown that conventional methods of experimental determination of J values are based on the following assumption: if the load deflexion curve is known for one value of the crack length it is possible to know the load deflexion curve for any value of the crack length. This assumption is generalized with the help of scale functions and formula giving J are deduced. Attention is given to the effect of crack propagation on J values. The same assumption is used to extract the crack length from the load deflexion curve. As the real crack lengths are known before propagation occurs and at the end of the test, it is possible to achieve a good calibration of the material characteristic. DOE

N83-15674# Ben Gurion Univ. of the Negev, Beersheva (Israel). Dept. of Mechanical Engineering.
MINIMUM-WEIGHT DESIGN OF AN ORTHOTROPIC SHEAR PANEL WITH FIXED FLUTTER SPEED
L. Beiner and L. Librescu Oct. 1982 23 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal, May or Jun.
Avail: NTIS HC A02/MF A01

The weight minization of a flat rectangular panel of arbitrary aspect ratio placed in a high supersonic flow field and subjected to a flutter speed constraint is studied. A pure transverse shear plate model was used to establish the structural operator. The aerodynamic operator results from the employment of the piston theory aerodynamics. The problem is treated in the framework of optimal control of distributed parameter systems. Necessary conditions for the minimum weight panel are derived, which are supplemented with a condition ensuring that the flutter speed of the optimum panel coincides with the prescribed one. These conditions result in a thickness distribution symmetrical with respect to the panel midpoint. Numerical rough estimates of the optimum thickness distribution obtained via Galerkin's method are presented, in which the influence of the orthotropicity degree is put into evidence. S.L.

N83-15675# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Stuctures Lab.
THE HEMSS 3T EXPERIMENT Final Report
Anthony A. Bombich Jul. 1982 72 p refs
(AD-A120669; WES/MP/SL-82-10) Avail: NTIS HC A04/MF A01 CSCL 11/2

As a result of this investigation, it was found that the HEMSS 3T cylinder successfully duplicated the conditions in the HEMSS No. 3 field-cast cylinder except for the slightly lower peak temperature. Generally, the measureable effects of high temperature on the grout properties were not significant. Large differences were found between measured and calculated strain values. Also, strains measured by two different strain gages were substantially different. These differences are attributed to differences in the coefficients of thermal expansion of the grout and the gages. Some fracturing or material degradation occurred near the periphery of the HEMSS 3T cylinders which was attributed to the thermal restraint effects of the corrugated steel culvert used as the forms. It is recommended that lubricated forms rather than corrugated culverts be used for the outer forms. GRA

N83-15676# Pisa Univ. (Italy). Inst. of Aeronautics.
THE FATIGUE CRACK GROWTH UNDER VARIABLE AMPLITUDE LOADING IN BUILT-UP STRUCTURES Final Technical Report, Sep. 1978 - Feb. 1982
A. Salvetti, G. Cavallini, and L. Iazzeri Apr. 1982 124 p refs
(Grant DA-ERO-78-G-107; DA Proj. 1T1-61102-BH-57)
(AD-A119764) Avail: NTIS HC A06/MF A01 CSCL 01/5

Seventy-four specimens, made of 2024-T3 aluminum alloy, were tested both at constant and variable amplitude loading. The specimens were both simple sheets and riveted stiffened panels. The constant amplitude tests on simple sheet specimens were conducted in order to obtain the average K-rate relationship and the relevant scatter of the batch of sheets. The constant amplitude tests of stiffened panels aimed at obtaining information on the overall junction flexibility. Variable amplitude tests were performed utilizing three standard fatigue spectra, like FALSTAFF, MINITWIST, and Gaussian random. The data from sheet specimens was used to assess the reliability of prediction methods such as those devised by Wheeler and Willenborg, and the stiffened panels test data to evaluate how these methods work in the case of built-up structures. Some general conclusions on the reliability of the crack growth prediction methods have been obtained treating on statistical basis the data collected in the current year, as well as in the previous year's research activity. To this end, data from variable amplitude tests, irrespective of the type of spectrum and of the material, has been collected and analyzed in order to evaluate in this respect the methods proposed by Willenborg and by Wheeler. The results are quite interesting, because they allow to evaluate the scatter associated with most of the parameters involved in crack growth predictions. GRA

N83-15677# California Univ., San Diego, La Jolla.
RESEARCH IN SHELL THEORY Final Report, 1 Sep. 1974 - 28 Feb. 1982
Eric Reissner Aug. 1982 8 p refs
(Contract N00014-75-C-0158)
(AD-A120829) Avail: NTIS HC A02/MF A01 CSCL 12/1

Summary of research results on Formulation of theories of elastic shells, plates and beams are discussed. Unconventional beam buckling problems are solved. Stress concentrations in shells due to holes or rigid inserts are investigated. Deflection bounds for unconventional beam problems are also discussed. GRA

N83-15678# Propellants, Explosives and Rocket Motor Establishment, Waltham Abbey (England).
RELIABILITY ANLYSIS OF STRUCTURES WITH WEIBULL DISTRIBUTIONS OF LOAD AND STRENGTH TO A GIVEN CONFIDENCE LEVEL
J. Margetson and J. F. Laurillard Jul. 1982 27 p refs
(AD-A120017; PERME-TR-182; DRIC-BR-83968) Avail: NTIS HC A03/MF A01 CSCL 12/1

The statistical variation of load and strength is described by a three parameter Weibull distribution. The Weibull parameters are evaluated by a least square analysis and a method is presented which allows confidence bounds to be assigned to these quantities. A Monte Carlo analysis is used to calculate the reliability of the structure from the load and strength distributions. GRA

N83-15679# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
FAILURE DESIGN OF THICK-WALLED CYLINDERS CONSIDERING THE OD AS A FAILURE INITIATION SITE Final Report
J. A. Kapp and S. L. Pu Sep. 1982 38 p refs Presented at the ASME Pressure Vessel Design Conf., Orlando, Fla., Jun. 1982
(DA Proj. 1A1-25873-1A-1A)
(AD-A120676; ARLCB-TR-82029) Avail: NTIS HC A03/MF A01 CSCL 12/1

The outside diameter (OD) of thick-walled pressure vessels is considered as the initiation site for fatigue failure of the cylinder. OD failures can occur in pressurized cylinders which have discontinuities machined on their outside surfaces, and have been strengthened by the autofrettage process. Both the crack initiation and crack propagation phases are discussed. To do this, finite element stress solutions for OD notched thick-walled cylinders and specialized fracture mechanics solutions are presented. Life and crack growth predictions based on these analyses are compared to previously performed experiments. GRA

N83-15680# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
EQUILIBRIUM CONDITIONS FOR THE AVERAGE STRESSES MEASURED BY X-RAYS
I. C. Noyan 30 Sep. 1982 28 p refs
(Contract N00014-80-C-0116)
(AD-A120750; TR-8) Avail: NTIS HC A03/MF A01 CSCL 20/11

True macro-stresses are measured with x-rays after material processing, only if there is a uniform plastic deformation in the sampled volume that is different than that in the rest of the material. In this stress-field the components in the direction of the surface normal are usually negligible over the depth penetrated by X-ray (for example, peening). However, pseudo-macrostresses, or backstresses, arise when this condition is violated, for example, if there are second phase particles and there is a gradient of plastic deformation from particle to matrix. This pseudo-macrostress field is three-dimensional and the stresses in the direction of the surface normal can be measured with X-rays. Equations are presented which allow estimates to be made of the magnitudes of the two kinds of stress fields. GRA

N83-15681# Maryland Univ., College Park. School of Engineering.
STRESS CONCENTRATIONS
A. J. Durelli Sep. 1982 103 p refs
(Contract N00014-81-K-0186)
(AD-A120701; Rept-60) Avail: NTIS HC A06/MF A01 CSCL 12/1

The scope of this work on Stress concentration includes critical studies of the presently available handbooks, geometrically non-linear problems, mixed boundary value problems, three-dimensional problems, dynamic stress concentrations and also deals with the advantages and limitations of the methods commonly used to determine stress concentration factors. GRA

N83-15682# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
EFFECTS OF R-RATIO ON CRACK INITIATION AT EXTERNAL DISCONTINUITIES IN AUTOFRETTAGED CYLINDERS Final Report
Robert R. Fujczak Jul. 1982 30 p refs Presented at the Spring Meeting of the Soc. for Exptl. Stress Anal., 22-30 May 1982, Honolulu, Hawaii
(DA Proj. 1L1-61101-A-91A)
(AD-A120716; AD-E440162; ARLCB-TR-82023) Avail: NTIS HC A03/MF A01 CSCL 20/11

Experimental work shows the effects of positive stress ratios, or tensile minimum stress, during the fatigue cycle on the fatigue crack initiation from holes. This simulates the effect of the residual tensile stresses at the outside surface of autofrettaged cylinders. S-N (stress life) curves and modified Goodman diagrams are shown for fatigue crack initiation. GRA

N83-15683# Army Materials and Mechanics Research Center, Watertown, Mass.
PROCEEDINGS OF THE ARMY SYMPOSIUM ON SOLID MECHANICS, 1982: CRITICAL MECHANICS PROBLEMS IN SYSTEMS DESIGN Final Report
Sep. 1982 505 p refs Symp. held in Cape Cod, Mass., 21-23 Sep. 1982
(AD-A119955; AMMRC-MS-82-4) Avail: NTIS HC A22/MF A01 CSCL 20/11

Contents: Shock-Impact; Fatigue and Fracture; Composite Structures; and Structural Design. GRA

N83-15684# Army Materials and Mechanics Research Center, Watertown, Mass. Ceramics Research Div.
FRACTURE ANALYSIS OF REACTION-BONDED SILICON NITRIDE TURBINE SHROUDS Final Report
Donald R. Messier, Liselotte J. Schioler, George D. Quinn, and James C. Napier Jun. 1982 45 p refs
(DA Proj. AL7-63702-DG-11)
(AD-A120769; AMMRC-TR-82-43) Avail: NTIS HC A03/MF A01 CSCL 01/3

Reaction-bonded silicon nitride turbine shrouds were examined after engine rig testing to determine failure mechanisms and evaluate material quality. Bend test specimens machined from the shrouds were approximately equal in strength to specimens cut from flat billets of virgin material. While most component and bend specimen fractures initiated at surfaces, internal origins were observed in some cases. Fracture mechanics analysis of as the bend test data yielded a value of Klc = 1.79 MN/m cubed/2 in agreement with literature data. Fracture mirror measurements indicated that shrouds failed at stresses approximately three times less than bend specimen. Probable causes for this were gross machining defects, size effects, and possible residual stresses. GRA

N83-15685# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
STRESS INTENSITY AND FATIGUE CRACK GROWTH IN A PRESSURIZED, AUTOFRETTAGED THICK CYLINDER Final Technical Report
A. P. Parker, J. H. Underwood, J. F. Throop, and C. P. Andrasic Sep. 1982 52 p refs Presented at the 14th Natl. Symp. on Fracture Mech., Los Angeles, 29 Jun. - 1 Jul. 1981
(DA Proj. 1T1-61101-A-91-A)
(AD-A120789; ARLCB-TR-82027) Avail: NTIS HC A04/MF A01 CSCL 20/11

Correction factors for crack shape and non-ideal material yielding are determined from various sources for the pressurized, autofrettaged tubes containing semi-elliptical cracks. These results are employed in the life prediction of pressurized thick tubes with straight-fronted and semi-circular cracks, for various amounts of autofrettage. Experimentally determined lifetimes for tubes having zero and 30 percent nominal overstrain are significantly greater than the predictions for both straight fronted and semi-circular cracks. This is related to multiple initiation and early growth of cracks from the notch. Experimentally determined lifetimes for a tube with a 60 percent nominal overstrain are somewhat less than predicted. This effect is partially explained by additional experimental work which shows that the angle of opening of rings cut from autofrettaged tubes is somewhat less than the ideal predictions. GRA

N83-15686# Naval Research Lab., Washington, D. C.
FURTHER TRIALS OF A STRAIN HARDENING INDEX OF FATIGUE DAMAGE Final Report
J. M. Krafft 28 Sep. 1982 22 p refs
(AD-A119912; NRL-MR-4922) Avail: NTIS HC A02/MF A01 CSCL 11/6

Previous cyclic strain; smooth specimen fatigue tests of alpha-beta titanium alloys displayed an anomalous endurance enhancement for some of the alloy conditions. This could be explained by associating resistance to fatigue damage directly with the stress normalized plastic strain hardening rate at the point of maximum cyclic tensile stress. Since this rate also controls the extent of stress relaxation induced tensile creep strain in each cycle, it was thought that fatigue damage might be associated with it. To test this hypothesis, data with varied load hold time, and over a full range of cyclic life, is reported here for some of the previously reported alloys of Ti-6Al-4V, as well as for an A36 steel plate. Notch fatigue tests of the A36, combined with those of Yoder et al for the titanium alloys, are compared to the smooth specimen data. Results tend to support the damage inhibiting role of the plastic strain hardening rate, but not of the creep strain portion of each cycle. Notch fatigue data agrees with smooth specimen trends if Neuber's rule is used to characterize the stress concentration factor, particlarly with the A36 steel. As with Yoder's notch fatigue results smooth specimen LCF life, though quite different in the range less than a thousand cycles, tends to converge near the endurance limit, thus mitigating adverse effects of alloy conditions which favor resistance to fatigue crack propagation in alpha-beta titanium alloys. GRA

N83-15687# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
SIMPLE EXAMPLES OF COMPLEX PHENOMENA IN PLASTICITY
Philip G. Hodge, Jr. Aug. 1982 33 p refs
(Contract N00014-82-K-0020)
(AD-A119840; AEM-H2-1) Avail: NTIS HC A03/MF A01 CSCL 20/11

In 1951 D. C. Drucker presented a classic example of a simple three bar system in which a single monotonically increasing external load produced an actual plastic stress reversal with one bar yielding first in tension and then in compression. This example is reviewed and built upon. Other simple examples illustrate general loading, unloading, and reloading of elastic/plastic structures, shakedown, and lack of uniqueness in contained plastic deformation. GRA

N83-15688# Atomic Energy of Canada Ltd., Pinawa (Manitoba). Nuclear Research Establishment.
DOUBLE-TORSION METHOD APPLIED TO GLASS, REPRODUCIBILITY OF DATA
W. G. Hutchings and B. J. S. Wilkins Apr. 1981 24 p refs In ENGLISH; FRENCH summary
(AECL-6811) Avail: NTIS HC A02/MF A01

The double-torsion (DT) method is widely used in fracture mechanics studies of cracking in brittle materials because of its versatility and convenience. In particular, it is a popular method of obtaining the parameters that relate slow crack growth velocity to the stress intensity factor. Useful prediction of the performance of brittle material needs reliable data. The ability of the DT method to provide reproducible data was examined using soda lime glass in water at room temperature. The results show that the method is extremely sensitive to experimental variables and prone to generating nonreproducible results. DOE

N83-15689# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics and Metallurgy Div.
ELASTIC WAVE RADIATION FROM CLEAVAGE CRACK EXTENSION
H. N. G. Wadley and C. B. Scruby Apr. 1982 21 p refs
(AERE-R-10351) Copyright. Avail: Issuing Activity

The elastic waves radiated from an isolated elastic microfracture of variable orientation and received at the epicenter of an elastic half space were calculated, and used to predict the acoustic emission signals that would be detected on various faces of a compact tension specimen. The displacements due to elastic waves radiated by incremental cleavage extension of precracks in such samples were been measured, both ahead of and vertically above the advancing cracks. These acoustic emission signals are found to differ from the predicted waveforms because of the presence of precrack free surfaces, along which disturbances propagate from the crack tip at the surface wave velocity. Their effect is to increase the amplitude of the acoutic emission signals and enhance their lower frequency content. The experimental results are consistent with recent elastodynamic calculations of elastic radiation from incremental crack advance. S.L.

N83-15690# Atomic Energy Research Establishment, Harwell (England). Metallurgy Div.
A STUDY OF THE STRESS RELIEF CRACKING SUSCEPTIBILITY OF A533B CLASS 1 AND A508 CLASS 3 STEELS
B. C. Edwards, C. A. Hippsley, and J. A. Hudson Jun. 1982 36 p refs
(AERE-R-10522) Avail: NTIS HC A03/MF A01

The stress relief cracking (SRC) susceptibility of particular casts of A533B Class 1 and A508 Class 3 stells was assessed by a constant displacement stress relaxation tests. The cracking susceptibility in the presence of a stress raiser, was determined. The SRC behavior of simulated coarse grained heat affected zone (HAZ) microstructures was determined for both steels and the effect of subsequent grain refinement of the HAZ was evaluated on the A533B cast. In the coarse grained HAZ samples of the A508 and A533B steels discontinuities in the load relaxation curves occurred which indicates the onset of cracking and complementary potential drop measurements monitored crack growth. Auger electron spectrocopy shows that low ductility intergranular fracture is associated with segregation of the trace impurities phosphorus and nitrogen to grain boundaries during the stress relief heating cycle. It is shown that for a comprehensive assessment of stress relief cracking susceptibility, cracking response should be monitored throughout the entire postweld heat treatment cycle and not just at the peak temperature. Author

N83-15297# MTS Systems Corp., Minneapolis, Minn.
LABORATORY TESTING SYSTEMS FOR STRUCTURAL DYNAMIC RESPONSE TO LARGE-SCALE DISTURBANCES
John W. Piraino *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 8 p refs (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

N83-15252# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A GENERALIZED J-INTEGRAL OF 2 DIMENSIONS
Zhang Xing (Beijing Inst. of Aeronautics and Astronautics) and Wu Guoxun (Beijing Inst. of Aeronautics and Astronautics) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 46-60 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

N83-15254# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPUTATION OF STRENGTH AND STABILITY FOR A BUILT STRUCTURE
Cai Yiping (China Aviation Research Inst.), Song Zenghao (China Aviation Research Inst.), Wang Zhihua (China Aviation Research Inst.), and Zhang Xianwu (China Aviation Research Inst.) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 78-89 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

N83-15692# Central Research Inst. of Electric Power Industry, Tokyo (Japan). Civil Engineering Lab.
SALT CONCENTRATION EFFECTS ON STRENGTH OF FROZEN SOILS
Nobuhide Ogata, Masayuki Yasuda, and Tetsuyuki Kataoki *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 3-10 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 20/11

N83-15693# Alberta Univ., Edmonton.
STRENGTH AND DEFORMATION BEHAVIOR OF FROZEN SALINE SAND
D. C. Sego, T. Shultz, and R. Banasch (UMA Group, Edmonton, Alberta) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 11-17 refs Sponsored in part by the National Science and Engineering Research Council of Canada (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 20/11

N83-15694# Ruhr Univ., Bochum (West Germany). Dept. of Civil Engineering.
FROZEN SALINE SAND SUBJECTED TO DYNAMIC LOADS
Hans L. Jessberger and Peter Jordan *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 19-26 refs Sponsored by Bundesminister fuer Forschung und Technologie (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 20/11

N83-15695# Michigan State Univ., East Lansing. Dept. of Civil Engineering.
BOND AND SLIP OF STEEL BARS IN FROZEN SAND
O. B. Andersland and M. R. M. Alwahhab *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 27-34 refs

(For primary document see N83-15691 06-42)
(Grant NSF CME-79-15784)
Avail: NTIS HC A20/MF A01 CSCL 20/11

N83-15696# Alaska Univ., College. Dept. of Civil Engineering.
EXCAVATION RESISTANCE OF ARTIFICIALLY FROZEN SOILS
Arvind Phukan and Shinji Takasugi *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 35-40 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 20/11

N83-15731# Academy of Sciences (USSR), Yakutsk. Inst. of Physical and Technical Problems of the North.
INTERACTION OF FROZEN SOILS WITH WELLS AND PIPELINES
M. M. Dubina *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 349-354 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/11

N83-15732# Huainan Mining Coll. (China).
STUDY OF THE FREEZING PRESSURE ACTING ON A SHAFT LINING
Chou Wanxi *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 355-366 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 20/11

N83-15734# Heilungkiang Provincial Low Temperature Construction Science Research Inst. (China).
STRENGTH DEVELOPMENT OF CONCRETE PLACED IN FROZEN SOIL AND THE THERMAL EFFECTS
Yang Yuji *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 375-382 (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 20/11

N83-15897# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
UNCERTAINTIES IN THERMAL-STRUCTURAL ANALYSIS OF LARGE SPACE STRUCTURES Final Report
Earl A. Thornton *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 17 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20K

42 GEOSCIENCES (GENERAL)

N83-15691# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
PROCEEDINGS OF THE THIRD INTERNATIONAL SYMPOSIUM ON GROUND FREEZING
1982 467 p refs Symp. held in Hanover, N.H., 22-24 Jun. 1982 (AD-A118885; CRREL-SR-82-16) Avail: NTIS HC A20/MF A01 CSCL 08/13

Artificial ground freezing and its application as a construction technique was examined. Predictions of the effects of freezing on soil properties and refrigeration requirements and placing freezing pipes are examined. The relation between theory, design and application in artificial ground freezing is emphasized. Four main topics are discussed: (1) mechanical properties and processes; (2) thermal properties, processes and analysis; (3) frost action; and (4) engineering design. For individual titles, see N83-15692 through N83-15738.

N83-15692# Central Research Inst. of Electric Power Industry, Tokyo (Japan). Civil Engineering Lab.
SALT CONCENTRATION EFFECTS ON STRENGTH OF FROZEN SOILS c39
Nobuhide Ogata, Masayuki Yasuda, and Tetsuyuki Kataoki *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 3-10 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 20/11

The mechanical properties of frozen soils were studied. The influence of salt concentrations on strength of frozen soils in underground or inground storage of cryogenic liquids was discussed. The construction of an LNG storage tank in the ground with no heating equipment around the tank, the ground will be frozen with the lapse of years. Frost heave in freezing of ground and the frozen earth pressure acting on the wall of the LNG tank was examined. Since LNG inground storage tanks are often constructed along the coast, frozen soils containing salt were tested. E.A.K.

N83-15693# Alberta Univ., Edmonton.
STRENGTH AND DEFORMATION BEHAVIOR OF FROZEN SALINE SAND c39
D. C. Sego, T. Shultz, and R. Banasch (UMA Group, Edmonton, Alberta) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 11-17 refs Sponsored in part by the National Science and Engineering Research Council of Canada (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 20/11

The strength and deformation behavior of frozen saline sand was investigated. Unconfined compression experiments were conducted at 70 C and at various strain rates. It is indicated that the strength and deformation are strain rate dependent and are strongly influenced by the concentration of the saline pore fluid. The behavior is best analyzed using a power law to indicate the relationship between both the strength and the deformation moduli with the strain rate. E.A.K.

N83-15694# Ruhr Univ., Bochum (West Germany). Dept. of Civil Engineering.
FROZEN SALINE SAND SUBJECTED TO DYNAMIC LOADS c39
Hans L. Jessberger and Peter Jordan *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 19-26 refs Sponsored by Bundesminister fuer Forschung und Technologie (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 20/11

The behavior of frozen ground subjected to dynamic loads were investigated. The test method, the equipment including the stress or strain control system, and the measurement devices for cyclic loaded triaxial tests are described. The sample preparation which provides a constant density and a certain salinity is described. The influence of temperature and frequency on the elastic and plastic deformation caused by cyclic triaxial loadings are reported. E.A.K.

N83-15695# Michigan State Univ., East Lansing. Dept. of Civil Engineering.
BOND AND SLIP OF STEEL BARS IN FROZEN SAND c39
O. B. Andersland and M. R. M. Alwahhab *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 27-34 refs (For primary document see N83-15691 06-42)
(Grant NSF CME-79-15784)
Avail: NTIS HC A20/MF A01 CSCL 20/11

Three bond components, ice adhesion, friction, and mechanical interaction between frozen sand and bar surface roughness, were measured. Initially, adhesion combined with friction prevents slip. After adhesion is broken and partial slip occurred, a small residual value for adhesion and friction controls the pull out load. Introduction of bearing action of frozen sand on a single lug greatly increased the pull out load. This load is estimated by steady displacement rate equation based on cavity expansion theory. The effects of loading and displacement rates, temperature, bar size, and lug size on the pullout load are reported. E.A.K.

N83-15696# Alaska Univ., College. Dept. of Civil Engineering.
EXCAVATION RESISTANCE OF ARTIFICIALLY FROZEN SOILS c39

Arvind Phukan and Shinji Takasugi *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 35-40 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 20/11

The excavation resistance of artificially frozen sand and silt was investigated. An apparatus is developed to simulate the field excavation technique in the laboratory. Frozen sand and silt soil samples at different temperatures are tested at different rake angles, cutting depths and cutting tool widths. Relationships are found for the cutting resistance against rake angles and cutting depths at different freezing temperatures. It is shown that a critical rake angle approximately 35 deg at which the tangential resistance is minimal, exists for frozen silt at a particular freezing temperature. This tangential resistance increases with lower temperatures of frozen silt. The failure characteristics of frozen sand and silt were different during the cutting process. Triaxial tests were carried out on the artificially frozen sands and silts at different temperatures. E.A.K.

N83-15697# Kuibyshev Civil Engineering Inst., Moscow (USSR). Lab. for Engineering Cryopedology in Power-Plant Construction.
HEAVING DEFORMATION AND THERMAL CREEP OF FROZEN, ICE-SATURATED, COARSE-GRAINED SOILS **c46**
N. A. Tsytovich, Y. A. Kronik, and A. N. Gavrilov *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 43-52 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

Heaving deformation and thermal creep of water saturated gravelly gruss soils and rock fill in their freezing and thawing was investigated. The deformative properties of artificially and naturally frozen ice saturated coarse grained soils with no fine grained filler are compared. The established laws of deformation of the soils are described on the basis of the thermal creep theory. Formulas are given for calculating the course of settlement of ice saturated coarse grained frozen soils with time. E.A.K.

N83-15698# Nottingham Univ. (England).
STRENGTH AND CREEP TESTING OF FROZEN SOILS **c46**
A. R. Gardner, R. H. Jones, and J. S. Harris (Foraky Ltd., Nottingham, England) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 53-60 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

A purpose built microcomputer controlled triaxial apparatus for testing frozen soils is described. The steel cell, which also acts as a reaction frame, is refrigerated by circulating coolant to temperatures down to -20 C. The use of a standard microcomputer for data acquisition and feedback control, in conjunction with other design features, resulted in a compact, self contained apparatus. Laboratory specimens of an unsaturated medium to fine sand were prepared by uniaxial freezing in an open system, and insitu frozen samples were recovered from a trial freezing site. It is indicated that similar creep behavior is obtained for both types of specimen. It is suggested that the method of uniaxial freezing in an open system gives specimens similar to those obtained in the field. E.A.K.

N83-15699# Alaska Univ., Fairbanks. School of Engineering.
PERMAFROST CREEP MEASUREMENTS IN THE CRREL TUNNEL **c46**
Nils I. Johansen and John W. Ryer (Dresser-Atlas Oil Field Service Group) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 61-64 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

Probable links between the significant settlement in the back portion of the permafrost tunnel and the tunnel geometry in this area and parameters of soil type, ground temperature, ice content and thickness of overburden were investigated. Measurements show a constant creep rate of approximately 0.05mm/day. The creep data will be helpful in predicting future behavior of the tunnel and assist in design of roof support system in frozen ground in areas subjected to constant creep. E.A.K.

N83-15700# Academia Sinica, Lanzhou (China). Inst. of Glaciology and Cryopedology.
ELASTIC AND COMPRESSIVE DEFORMATION OF FROZEN SOILS **c46**
Zhu Yuanlin, Zhang Jiayi, and Wu Ziwang *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 65-77 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

Compression laboratory tests on frozen soils at a constant negative temperature are discussed. The general behaviors of elastic and compressive deformation of frozen soils, and the experimentally obtained values of their characteristics, the normal elastic modulus-E and the summary relative compressibility coefficient gamma sigma of frozen soils are stated. Based on the influence of some factors such as negative temperature, moisture, soil composition and external pressure on the above two characteristics, two equations for estimating the normal elastic modulus are presented. Relative compressibility coefficient of frozen soils according to negative soil temperatures and the values of corresponding parameters for the equations are summarized. E.A.K.

N83-15701# Karlsruhe Univ. (West Germany). Inst. for Soil Mechanics and Rock Mechanics.
LONG-TERM CREEP OF FROZEN SOIL IN UNIAXIAL AND TRIAXIAL TESTS **c46**
Wolfgang Orth and Helmut Meissner *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 81-87 refs Sponsored by Deilmann Haniel G.m.b.H. (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

Frozen, fine grained, silty sand are tested in uniaxial and triaxial tests. The creep behavior is tested in triaxial compression and extension tests as well as in uniaxial creep tests of about 1000 hours duration. All samples had lubricated and enlarged end platens and a height to diameter ratio of 1.3 or less. It is shown that the creep behavior depends on the direction of the stress path in the deviatoric stress plane. The creep rate was never constant, a secondary creep phase was not observed. A creep law is proposed, which describes the observed creep behavior. E.A.K.

N83-15702# Michigan Technological Univ., Houghton.
COMPARATIVE RESPONSE OF SOILS TO FREEZE-THAW AND REPEATED LOADING **c46**
Bernard D. Alkire and James A. Morrison *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 89-96 refs Sponsored by NSF (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

The shear strength and pore pressures at failure obtained from consolidated undrained triaxial tests are discussed. Unfrozen monotonic, unfrozen, repeated, freeze thaw monotonic and freeze thaw repeated loading were used. All tests were loaded to failure. The various types of load and temperature conditioning and the effect of density and soil type are studied. The effect of the various tests on the structure of the soil are considered. It is shown that a soil subject to freeze thaw may be more sensitive to repeated loading than a soil that has not been subjected to freeze thaw. E.A.K.

N83-15703# McGill Univ., Montreal (Quebec). Dept. of Civil Engineering.
SHORT-TERM CYCLIC FREEZE-THAW EFFECT ON STRENGTH PROPERTIES OF A SENSITIVE CLAY **c46**
R. N. Yong, P. Boonsinsuk, and D. Murphy *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 97-103 refs Sponsored by the Ministry of Education of Quebec (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

The problem of strength changes due to cyclic freeze thaw effects in freshly cut slopes and surfaces in a sensitive clay soil not previously exposed to frost penetration is examined using undisturbed natural samples obtained from a field test site. In the tests conducted, the strength and thixotropic strength ratio of the

soil samples in the actual unfrozen state were first established - together with initial compositional characteristics. Following this, the samples were subjected to various cycles of freeze thaw, with strength properties measured after the first and eighth freeze thaw cycles. The effects obtained in the cyclic freeze thaw problem, together with compositional influences and control are discussed. M.G.

N83-15704# Worcester Polytechnic Inst., Mass.
MEASUREMENT OF SOIL THAW WEAKENING c46
J. D. Sage and R. A. DAndrea *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 105-112 refs Sponsored by DOT (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

The changes in strength which a soil experiences upon being subjected to frost heave and subsequent thaw are described. It is noted that localized areas of minimal strength occur where thawed water which formerly constituted an ice lens remains perched above soil which remains frozen. A device which allows study of this phenomenon within the laboratory is described. This device permits direct simple shear on a thin sample constituting the upper portion of a large cylindrical specimen which has been frozen from the top downward. Simple shear testing is performed under undrained conditions after the desired thermal history is applied. Temperature is controlled during thaw in order that the thin shear sample, whose top and bottom are parallel to the freeze thaw interface, will be underlain by frozen soil. Successive thawing and shearing of samples taken at various levels within the specimen produces the relationship between strength and depth for the initially imposed thermal conditions. Results of tests performed on a frost susceptible silty sand are also presented. M.G.

N83-15705# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
COMPARISON OF UNFROZEN WATER CONTENTS MEASURED BY DSC AND NMR c46
Joseph L. Oliphant and Allen R. Tice *In its* Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 115-121 refs (For primary document see N83-15691 06-42)
(DA Proj. 4A1-61102-AT-2401)
Avail: NTIS HC A20/MF A01 CSCL 08/13

Unfrozen water contents of various sands, silts and clays under partially frozen conditions were measured using nuclear magnetic resonance (NMR). Apparent specific heats for many of these soils were measured as a function of temperature using differential scanning calorimetry (DSC). Unfrozen water contents were calculated from the DSC data and compared with those directly measured with NMR. Comparisons were made from -20 C to 0 C with excellent agreement for samples with low salt contents. For these samples it is concluded that the assumptions made in calculating the unfrozen water contents from DSC data are good. M.G.

N83-15706# Research Inst. for Bases and Underground Structures, Moscow (USSR).
TEMPERATURE DEFORMATIONS OF FROZEN SOILS c46
V. D. Ponomarjov *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 125-130 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

Experimental and theoretical analyses of the temperature deformation of the permafrost are discussed. Experimental research showed that when cooling frozen soils in the temperature range corresponding to the range of intensive phase changes, contraction as well as expansion of the frozen soil is observed. The most probable reason for sign changing deformation of frozen soil on its cooling is presence of gaseous component and the possibility of deformation of crystals of pore ice on changing the volume of the gaseous phase in accordance with the changes of the temperature. M.G.

N83-15707# Norges Tekniske Hoegskole, Trondheim. Lab. of Physical Chemistry.
THE HYDRAULIC CONDUCTIVITY OF SOILS DURING FROST HEAVE c46
Signe Kjelstrup Ratkje, Hideo Yamamoto, Tsutomu Takashi, Takahiro Ohrai, and Jun Okamoto *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 131-135 refs Prepared in cooperation with Seiken Co. Ltd., Minami-ku, Japan (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

It is shown that the irreversible thermodynamic theory of frost heave as presented by Forland and Ratkje is verified by experiments. This theory predicts that the essential parameter of transport during frost heave is the hydraulic conductivity of the soil. Using the experimental data the hydraulic conductivity of Manaita-bridge clay and Negeshi silt was calculated for cooling temperatures as low as -29.44 C. The hydraulic conductivity decreases in value with decrease in temperature and is at least one order of magnitude smaller than its value predicted previously. M.G.

N83-15708# Queens Univ., Belfast (Northern Ireland). Dept. of Civil Engineering.
THERMAL PROPERTIES OF SOILS RELEVANT TO GROUND FREEZING. DESIGN TECHNIQUES FOR THEIR ESTIMATION c46
Omar T. Farouki *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 139-146 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

The limitations of the Kersten method of estimating thermal properties are described and other methods are proposed that give better estimates when applied to certain types and conditions of soils. In particular, knowledge of the soil quartz content is important as a basis for a more accurate estimate of the thermal conductivity of coarse soil, while for frozen fine soil the unfrozen water content may be important. Expected ranges of thermal conductivity values are given for fine, and for coarse, soils that may be unfrozen or frozen and have various dry densities and moisture contents. Depending on the volumetric heat capacity of the soil, a calculation can be made of its thermal diffusivity which influences the magnitude and rate of temperature changes. The factors which cause changes in the thermal conductivity and other relevant properties of a soil upon freezing are discussed. M.G.

N83-15709# Institute on Physical and Technical Problems of the North (USSR).
THERMOPHYSICAL CHARACTERISTICS OF FROZEN, FREEZING-THAWING, AND THAWED ROCKS AND METHODS OF THEIR MEASUREMENT c46
P. I. Philippov, A. V. Stepanov, and A. W. Timofeev *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 151-154 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

The evaluation methods of frozen thawing and thawed rock thermophysical characteristics (volumetric heat capacity, coefficients of heat and temperature conductivities) are described. The results concerning the grinded rock heat conductivity coefficient as a function of moisture and the cyclic freezing influence on the clay and sand soil thermophysical properties are presented. M.G.

N83-15710# Ruhr Univ., Bochum (West Germany). Dept. of Civil Engineering.
MODELING THE INTERACTION BETWEEN SOIL FREEZING SYSTEM AND THERMAL REGIME IN SOILS USING FEM c46
Eugen Makowski *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 157-166 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

Results of a project related to the development and use of soil freezing system for special conditions such as inhomogeneous soil and rock structure with different thermal properties and unequal locations of freeze pipes are presented. To investigate these problems a basic finite element method program was extended under following aspects: use of models of proved accuracy for the transient heat transfer in soils, the temperature dependent

thermal properties, and the release of latent heat; development of techniques to model the behavior of the freeze system components; and description of the interaction between soil freezing system and the thermal regime in soils. M.G.

N83-15711# Kuibyshev Civil Engineering Inst., Moscow (USSR). Lab. for Engineering Cryopedology in Power Plant Construction.
THERMOMECHANICAL ENTHALPY MODEL FOR GROUND FREEZING DESIGN **c46**
Y. A. Kronik *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 167-176 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

Existing enthalpy models of ground freezing are analyzed. Their shortcomings do not permit calculations of temperature conditions to be carried out for artificial ground freezing. A method of ground freezing design is proposed, based on the thermomechanical enthalpy model. It takes into consideration the phase transitions throughout the range of soil temperature variation, from absolute zero to any plus temperature. This physicomathematical model is based on experimental data and, in a first approximation, takes into account the mechanical and physicochemical processes, the initial state and variability of soil characteristics depending upon changes in their temperatures, and stressed strained states. The model includes four zones of freezing soil, which are specified in ranges of characteristic temperatures established experimentally. The model was checked by the finite element method in calculations and the thermal stressed strained state of soils. M.G.

N83-15712# Tokyo Gas Co. Ltd. (Japan). Production and Engineering Dept.
THERMAL ANALYSIS OF THE POSITION OF THE FREEZING FRONT AROUND AN LNG IN-GROUND STORAGE TANK WITH A HEAT BARRIER **c46**
o. Watanabe and M. Tanaka (Kajima Inst. of Construction Technology) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 3-10 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

A technique of controlling the extent of the freezing zone created by in ground liquefied natural gas storage tanks by installing a heat barrier is described. The freezing conditions around three representative tanks after operating the system were compared. M.G.

N83-15713# Fisica Tecnica, Florence (Italy).
EXPERIMENTAL RESULTS ON THE FREEZING OF SATURATED SANDS **c46**
Fabio Gori and Maura Ughi (Ist. Matematico, Florence, Italy) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 185-191 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

Experimental freezings of two liquids (water and tert-amyl-alcohol) in sands were carried on in a closed system. A sand with known grain size distribution, mineralogic composition and physical properties has been used. An experimental apparatus reproducing a one dimensional heat transfer phenomenon was set up. The low plane was thermally insulated and the upper one was kept at constant temperature. A procedure of vibration of the sand was employed to have a uniform liquid regain distribution at the beginning of the cooling. Temperature was measured at different distances from the cold source during the cooling. Liquid regain distributions were measured at the end of the freezing process with the oven drying method. Conductive heat transfer with change of phase was theoretically investigated. The energy equation was solved numerically with the finite difference method of Crank. The thermal conductivity of the wet sand was determined. M.G.

N83-15714# Ruhr Univ., Bochum (West Germany). Inst. of Konstruktiver Ingenieurbau.
EXPERIENCES AND INVESTIGATIONS USING GAP FREEZING TO CONTROL GROUND WATER FLOW **c43**
Heinz-Bernd Einck and Albert Weiler *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 193-204 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/8

The use of gap freezing to control ground water flow for construction projects is discussed. Flow behavior in the vicinity of the frozen parts of soil was investigated. Heat flow effects were considered. M.G.

N83-15715# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
FREEZING OF SOIL WITH SURFACE CONVECTION **c46**
V. J. Lunardini *In its* Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 205-212 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

An approximate solution for the surface convection ground freezing problem is derived and practical graphs are presented for the depth of freeze, with equations for surface temperature, and surface heat flux versus time. Author

N83-15716# Rutgers - The State Univ., Piscataway, N. J. Dept. of Civil and Environmental Engineering.
THERMAL MODELING OF FREEZE-THAW DEPTHS IN SOILS **c46**
Alfreds R. Jumikis *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 213-216 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

A discussion on thermal modeling of freeze thaw depth of the Saalschutz-Stefan formula is given. The modeling shows that it is correct in model frost freezing tests to work with the same temperatures as they are to be expected in the in situ prototype. The time of duration for modeling should not be assumed arbitrarily, but should be derived from the model time scale. Modeling renders reliable information that helps to evaluate the performance of the prototype, and adds a certainty to design which can never be obtained from mathematics alone. Modeling may warn against errors in prototype design. R.J.F.

N83-15717# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
INITIAL STAGE OF THE FORMATION OF SOIL-LADEN ICE LENSES **c46**
Shunsuke Takagi *In its* Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 223-232 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

Equations for frost heave in the saturated soil/water system reduce to heat conduction equations on introduction of two simplifying assumptions. The reduced equations are solved by use of the recently developed analytical method that can solve the Stefan problem with arbitrary initial and boundary conditions. The initial study of the solution shows that both the lensing front and the penetration front descend in proportion to the square root of t but the ice lens rises in proportion to t, at least for some time after the start of the lensing. The descent of the lensing front means that soil particles are picked up during the ice lens formation of soil laden (dirty) ice lenses, while the traditional ice lenses are soil free (clear). The above temporal relationships last much longer than the initial stage. Computation of the solution is now in progress. R.J.F.

N83-15718# Ecole Nationale des Ponts et Chaussees, Paris (France).
CRYOGENIC SUCTION IN SOILS **c46**
D. Blanchard and M. Fremond (Lab. Central des Ponts et Chaussees) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 233-238 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

A model of cryogenic suction based on classical notions of the macroscopic theory of continua is given. These are mainly the deformability of the soil considered as a porous medium and

the existence of unfrozen water in the frozen part of the soil. This model describes only the thermal and hydraulic aspects of the freezing of soils but cannot handle the mechanical aspects such as heaving. The computations made in one dimension agree with every experimental fact which have been observed in frost susceptible soils. R.J.F.

N83-15719# National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
ASPECTS OF ICE LENS FORMATION **c46**
E. Penner *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 239-245 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

It is possible to locate a growing ice lens in a frost heave cell in soil under laboratory conditions by means of a recently devised X-ray technique. If temperature distribution is measured in the sample at the same time, the temperature of the growing face of the ice lens can be determined. This method was validated under a range of heaving conditions. It was done by determining ice lens temperatures at various overburden pressures and cold side temperatures; then, by adjusting the ice lens temperature for overburden pressure and pore water salt content, the remaining difference from 0 C was expressed in terms of suction. Suction gradients in unfrozen soil under various freezing conditions were subsequently plotted as a function of rate of moisture flow and a porportionality was shown to exist. R.J.F.

N83-15720# Seiken Co. Ltd., Minami-ku (Japan).
EFFECT OF SPECIMEN HEIGHT ON FROST HEAVE RATIO IN UNIDIRECTIONAL FREEZING TEST OF SOIL **c46**
Tsutomu Takashi, Takahiro Ohrai, Hideo Yamamoto, and Jun Okamoto *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 247-254 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

Relations between specimen height and the frost heave ratio were examined systematically changing such freezing conditions as overburden pressure and frost penetration rate in open system frost heave tests of Manaitabridge clay collected in Tokyo. The frost heave ratio (defined as the ratio of volume increment to initial volume of a specimen) reaches a maximum at a certain value Ho of the specimen height H. When $H > Ho$, then the frost heave ratio decreases with increasing H, which can be explained quantitatively by resistance in soil water movement through the unfrozen part of specimen. Meanwhile, the frost heave ratio decreases with decreasing H, when $H < Ho$, which can be explained qualitatively by existence of an in situ water freezing zone within frozen soil. For this clay, which is markedly frost susceptible, Ho obtained ranges between 2 and 4 cm. In general, Ho depends on the soil type and freezing condition. In a laboratory frost heave test, Ho is looked on as the optimum height of a specimen. R.J.F.

N83-15721# Heilungkiang Provincial Low Temperature Construction Science Research Inst. (China).
FREEZING RATE AND FROST HEAVE OF SOILS **c46**
Liu Hongxu *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 255-259 (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

Results obtained through analyzing the relationships existing among freezing speed, expansion speed on freezing, negative temperature gradient, expansion rate, and frost heave are discussed. When a soil is freezing at a lower temperature, there exists a greater temperature gradient, higher freezing speed, and a higher expansion speed on freezing from which a higher expansion rate results. Water content, type of soil, and temperature are important factors. R.J.F.

N83-15722# Shimizu Construction Co. Ltd. (Japan).
FROST HEAVE CHARACTERISTICS OF SOIL UNDER EXTREMELY LOW FROST PENETRATION RATE **c46**
Shigeru Goto and Yukishige Takahashi (Tokyo Gas Co. Ltd., Japan) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 261-268 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

Results of the open system laboratory frost heave test which were conducted to examine the frost susceptibility of soil under the stationary condition of nominally zero frozt penetration rate are given. The condition was induced by controlling boundary temperatures to maintain a level of freezing front. Tests on all specimens have indicated continual heaving even after 2100 hrs. long after the nominally zero frost penetration rate which was achieved in the earlier stage of the tests. Furthermore, it is important that the frost heave rate decreases as time elapse. Analysis shows that the rate of frost heave and, in turn, its amount are influenced mainly by such factors as a degree of overburden pressure, and cold-side temperature. An empirical formula for an estimation of the frost heave amount, beyond the termination of the frost penetration is given. R.J.F.

N83-15723# Shimizu Construction Co. Ltd. (Japan).
FROST HEAVE SUSCEPTIBILITY OF SATURATED SOIL UNDER CONSTANT RATE OF FREEZING **c46**
Kimitoshi Ryokai, Mizuhito Iguro, and Kiyoshi Yoneyama (Tokyo Gas Co. Ltd., Japan) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 269-276 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

Introduced are the results of experiments carried out to quantitatively obtain the frost heave pressure and displacement of soil subjected to artificial freezing or freezing around in-ground liquefied natural gas storage tanks. This experiment is conducted to evaluate the frost heave susceptibility of saturated soil under overconsolidation. In other words, this experiment was carried out to obtain the relation of the over-burden pressure and freezing rate to the frost heave ratio by observing the frost heave displacement and freezing time of specimens by freezing the specimens at a constant freezing rate under a constant overburden pressure, while letting water freely flow in and out of the system. Introduced are the procedures for frost heave test required to quantitatively obtain the frost heave displacement and pressure of soil. Furthermore, the relation between the frost heave susceptibility and physical properties of soil obtained by this test is reported. R.J.F.

N83-15724# Geos, Inc., Montreal (Quebec).
FROST SUSCEPTIBILITY TESTING OF A COMPACTED GLACIAL TILL **c46**
P. Garand and B. Ladanyi (Ecole Poytechnique, Montreal) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 277-284 refs Sponsored by Dept. of Education of Quebec (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08G

An experimental method is presented for determing the frost susceptibility of compacted earth materials by measuring the maximum drop of hydraulic potential generated at the warm side of the supercooled fringe during segregational freezing. This potential drop was found to be relatively independent of the soil skeleton microstructure and of the degree of saturation during compaction, but increased with the thermal gradient. The maximum rate of frost heaving also increased with increasing thermal gradient but decreased with an increasing saturation during compaction. The results of frost heaving tests were compared with two mathematical models for representation of frost heave test results. R.J.F.

N83-15725# Aston Univ., Birmingham (England). Dept. of Civil Engineering.
HEAVING PRESSURES AND FROST SUSCEPTIBILITY **c46**
E. Y. McCabe and R. J. Kettle *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 285-294 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

When frost susceptible soils freeze and the heave is restricted, heaving pressures are generated which will threaten pipelines or structural units embedded in the soil. The evaluation of the maximum heaving pressure for individual soils is discussed. Heaving pressures measured under laboratory conditions are presented. Cylindrical specimens, of either 120 mm or 145 mm diameter, were subjected to freezing from the top surface in an open system. Heave was restricted by a stiff reaction frame and the heaving pressures were monitored continuously. During freezing the specimen was supported in a multi-ring cell which climinated friction between the sample and the mould and prevented adfreeze at this interface. The initial tests were performed on a highly frost susceptible mixture of sand and ground chalk and included a study of the influence of specimen size and thermal parameters on heaving pressure. The frost susceptibility of this matrix was modified by additions of between 10 and 50 percent of selected coarse particles, sub-divided into two groups of 3.35-20 mm and 20-37.5 mm. It is clear that the heaving pressures increase with freezing time but at an ever decreasing rate. R.J.F.

N83-15726# Nottingham Univ. (England).
GROUND MOVEMENTS ASSOCIATED WITH ARTIFICIAL FREEZING **c46**
R. H. Jones *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 295-304 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

The possibility of ground movements (frost heave or settlement after thawing) when using artificial ground freezing (AGF) as the temporary support for tunnels and shafts in close proximity to other structures is discussed. Two groups of AGF case histories, are considered namely: major shafts sunk in Britain between 1947 and 1976 and tunnels reported at meetings in 1978 and 1980. Published and unpublished data was synthesized to provide a state of the art review of movements, particularly heave, which have been associated with AGF; methods used to predict heave; and techniques for limiting movements. The shafts form two sub-groups within which common features permit useful comparisons. Conditions in the tunnels were more diverse. However, with proper attention to techniques on site, movements associated with tunnelling using AGF are generally acceptable and compare favorably with other alternative methods of construction. It is concluded that a check list for case histories and some form of reference testing for frost heave would facilitate future studies. R.J.F.

N83-15727# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
FROST ACTION OF FREEZING GROUND SURROUNDING UNDERGROUND STORAGE OF A COLD LIQUID **c46**
Seiiti Kinosita, Masami Fukuda, Takeshi Ishizaki (Tokyo Gas Co. Ltd., Japan), and Hideo Yamamoto (Seiken Co. Ltd., Osaka) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 305-309 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

A small tank in the shape of a cylinder 80 cm in diameter and 50 cm in depth was placed in a basin, filled with a silty soil, of the frost test field in Tomakomai, Hokkaido Japan, with its top at the same level as the ground surface in the basin. The double wall (two steel sheets 10 cm apart) constituted the exterior of the side and bottom. As a cold liquid at temperature of -23 C was poured inside the gap of the double wall and circulated, the soil around the tank began to freeze sideways and downwards from the tank. Studies made are as follows: (1) the progress of the freezing front was measured and preestimated; (2) frost heaving characters of the tank and the ground surface around it were observed; (3) soil water migration was calculated by measuring moisture tensions at several points within the soil; (4) soil pressure acting on the tank was measured. Author

N83-15728# Deilmann-Haniel G.m.b.H., Dortmund (West Germany).
GROUND FREEZING APPLICATIONS IN UNDERGROUND MINING CONSTRUCTION **c43**
Bernd Braun and William R. Nash (Frontier-Kemper Constructors) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 319-326 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/9

The paper outlines applications of ground freezing work in underground mine construction in the United States. Author

N83-15729# Kentucky Univ., Lexington. Dept. of Mining Engineering.
CONTROL OF FREEZING PROCESS ON EXAMPLE OF DEEP SHAFTS SUNKEN FOR POLISH COPPER MINES **c43**
Kot F. Unrug *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 327-336 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/9

Copper deposit in Polish lower silesia district is covered by thick, up to 430 m, Tertiary and Quanternary overburden consisting of waterbearing sands, gravels and also coherent strata with different consistency as clays, weak shales and lignites. Several problems encountered during sinking of the first shafts resulted in considerable improvement of designing and control of the applied freezing method. Within the frozen complex some most trouble creating strata have been specified and extensive testing program was carried out to record their mechanical and thermal characteristics. The freezing pipe design also has been changed, to prevent ruptures and brine escapes into the rock mass, as well as was established the optimum radius of the circle and distance of freezing holes. It has been found that the current control of the propagation of frozen mantle and its thickness is essential for safe sinking. B.W.

N83-15730# Shaktspetsstroy, Moscow (USSR).
EMPLOYMENT OF ROCK FREEZING TECHNIQUES FOR SINKING DEEP MINE SHAFTS **c43**
I. F. Losj, I. N. Florov, Yu. A. Lownin, and V. M. Varenishev *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 337-348 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/9

In the USSR two mine shafts were constructed with the application of deep (620 m) rock freezing technique. The whole of the rock mass were frozen from the surface to the final depth since within this depth range the rocks were flooded and some of them unstable. Author

N83-15731# Academy of Sciences (USSR), Yakutsk. Inst. of Physical and Technical Problems of the North.
INTERACTION OF FROZEN SOILS WITH WELLS AND PIPELINES **c39**
M. M. Dubina *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 349-354 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/11

When designing reliable structures of the wells bored in permafrost, it is necessary to make use of some calculation methods to estimate the mechanical effects of thermal interaction between these structures and surrounding frozen soil. In this paper irreversible strain manifestation in permafrost near uncased well during ground defrostation and thawing produced by the heat release within the hole is considered. Corresponding mechanical problem solution is used to estimate the geometrical parameters of wellbore wall forming during this process. Then relations for calculation of the freeze-back pressures both at freezing of the water bear masses outside of a string set and at its congelation within the interesting space are suggested. The calculation models are established according to the methods of the theory of plasticity and those of viscoelasticity. Author

N83-15732# Huainan Mining Coll. (China).
STUDY OF THE FREEZING PRESSURE ACTING ON A SHAFT LINING **c39**
Chou Wanxi *In* CRREL Proc. of the 3d Intern. Symp. on Ground

Freezing 1982 p 355-366 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 20/11

The carboniferous layer in Panji coal mining district is almost completely covered by water bearing overburdens of varying thickness. The total thickness of soil overburdens is more than 200 m. For the sinking of shafts through this overburden the freezing method is employed. The reinforced concrete lining has been applied in Panji shafts. It is found that freezing pressure augments with the increase of depth of the soil, the distribution of which being uneven. The freezing pressure resulting from the deformation of the freezing wall is likely to give rise to the breaking of the reinforced concrete lining. Author

N83-15733# Lulea Univ. (Sweden).
FIELD STUDY OF INSTRUMENTED GULLIES AND MANHOLES IN FROST-SUSCEPTIBLE SOILS c46
Sven Knutsson *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 367-374 refs Sponsored by Swedish National Board for Technical Development and Swedish Council for Building Research (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/7

In order to study the behavior of manholes and gullies with and without a newly invented rubber sleeve mounted over the joints, a field test was performed during the winter 1980/81 in Lulea, Sweden. It concerned 11 gullies, 3 of which were constructed in a conventional way and 8 with rubber sleeves. They were all located in highly frost susceptible soils and were exposed to frost heave. The paper describes the instrumentation installed as well as the results obtained. The growth of the frost bulb around the gullies, as well as movements in these and in the surrounding soil are reported. The results of the full scale tests have shown that the new rubber sleeve almost completely prevents damage of the gullies. Author

N83-15734# Heilungkiang Provincial Low Temperature Construction Science Research Inst. (China).
STRENGTH DEVELOPMENT OF CONCRETE PLACED IN FROZEN SOIL AND THE THERMAL EFFECTS c39
Yang Yuji *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 375-382 (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 20/11

A complex admixture (NANO2-NA2SO4) is described which can make concrete placed in frozon soil to reach its design strength. A lot of testing data, which were adopted in some projects, are given in the paper. In addition, this paper describes the thermal effect of hydration heat of cement on frozen soil surrounding the concrete placed. The thermal effect in frozen soil (range of thermal effect, thawing depth and freezing-interval) was measured for concrete with heated aggregates and unheated aggregates. Recommendations for use of such admixture are given in the paper. B.W.

N83-15735# Foraky Ltd. (England).
CONSTRUCTION OF TWO SHORT TUNNELS USING ARTIFICIAL GROUND FREEZING c31
John S. Harris and E. Hugh Norie (Mott, Hay and Anderson, Consultants, England) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 383-388 (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 13/2

As part of a pipeline upgrading scheme, a short length of new tunnel was required between two existing shafts each lying close to a water course - a river estuary and a sea-going canal. Horizontal freeze tubes were drilled into place toward each old shaft from a new larger diameter shaft sunk at the mid point. Following refrigeration by an ammonia-brine system the tunnels were advanced by hand excavation and lined with bolted concrete segments. The freeze tube drilling toward the canal shaft encountered a consistent timber obstruction just short of their intended length. The method of drilling and placing horizontal freeze-tubes below the ground water table in alluvial soils, with a minimum of ground disturbance and loss is described. B.W.

N83-15736# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
A CASE HISTORY OF A TUNNEL CONSTRUCTED BY GROUND FREEZING c31
Hugh S. Lacy (Freezewall, Inc.), John S. Jones, Jr. (Law Engineering Testing Co., Washington, D.C.), and Brien Gidlow (OBrien and Gere Engineers, Inc., Syracuse, N.Y.) *In its* Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 389-396 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 13/2

Artificial ground freezing was used for structural support and groundwater control for a 37 m long, 3.2 m diameter tunnel located about 2 m beneath high speed railroad lines in Syracuse, New York. A double row of freeze pipes spaced approximately 0.9 m on-center was used around the periphery of the tunnel above the spring line, while only a single row of freeze pipes was required below the spring line. Excavation of the frozen soil within the tunnel was accomplished with a small road header tunnel boring machine. The results of in situ testing of frozen soil, laboratory testing of frozen soils, computer analysis to predict stress deformation-time characteristics under static and cyclic loading, the instrumentation program including a comparison of estimated and measured performance are discussed. B.W.

N83-15737# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
GROUND FREEZING IN TUNNELS: THREE UNUSUAL APPLICATIONS c46
Derek Maishman and J. Patrick Powers *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 397-410 ref (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

The three case histories described herein illustrate the broad versatility of the ground freezing method in solving tunneling problems. It is possible to construct various types of underground structures of frozen earth, to cutoff water and to support loads. These case histories illustrate a horizontal cylinder, an arch, and a bulkhead, all of frozen earth. Other shapes are possible, their variety limited only by the ingenuity of the designer. Author

N83-15738# Linde A.G., Munich (West Germany). Industrial Gases Div.
NEW FREEZE PIPE SYSTEMS FOR NITROGEN FREEZING c31
Dieter Rephan *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 429-435 (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 13/2

A number of field and laboratory experiments have been carried out using new kinds of freezing pipe systems. These systems particularly enable freezing to be performed in stages. They further enable liquid gas consumption to be minimized. One system is particularly suitable for shaft freezing while another lends itself to tunnelling. Author

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N83-15739* General Electric Co., Fairfield, Conn.
LANDSAT-D: THE NEW ERA OF EARTH RESOURCES SURVEY
[1982] 12 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E83-10125; NASA-CR-169727; NAS 1.26:169727) Avail: NTIS

HC A02 CSCL 22B

The history of the development and utilization of LANDSAT satellites is summarized. Objectives of the LANDSAT D mission are listed and the capabilities of the 4-channel multispectral band scanner and the 7-channel radiometer (thematic mapper) to be carried on the satellite are described. Satellite components are illustrated and diagrams show the ground segment data management system, the data assessment system, and the operations control center. The flight segment of the mission and flight segment specifications are also described. Examples of digitally analyzed and ehanced imagery are included. A.R.H.

N83-15740*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.

AUTOMATED SEGMENT MATCHING ALGORITHM-THEORY, TEST, AND EVALUATION

M. T. Kalcic, Principal Investigator Jun. 1982 46 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Proj. AgRISTARS)

(E83-10096; NASA-TM-85192; DC-Y2-04325; NSTL/ERL-209; NAS 1.15:85192) Avail: NTIS HC A03/MF A01 CSCL 02C

Results to automate the U.S. Department of Agriculture's process of segment shifting and obtain results within one-half pixel accuracy are presented. Given an initial registration, the digitized segment is shifted until a more precise fit to the LANDSAT data is found. The algorithm automates the shifting process and performs certain tests for matching and accepting the computed shift numbers. Results indicate the algorithm can obtain results within one-half pixel accuracy. A.R.H.

N83-15741*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

GATES TO GREGG HIGH VOLTAGE TRANSMISSION LINE STUDY

Virginia Bergis, Keith Maw, Willard Newland, D. Sinnott, G. Thornbury, P. Easterwood, and J. Bonderud Dec. 1982 152 p refs Prepared in cooperation with Technicolor Government Services, Inc., Moffett Field, Calif. and Pacific Gas and Electric Co., San Francisco Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Contract NAS2-11101)

(E83-10097; NASA-TM-84314; A-9182; NAS 1.15:84314) Avail: NTIS HC A08/MF A01 CSCL 08B

The usefulness of LANDSAT data in the planning of transmission line routes was assessed. LANDSAT digital data and image processing techniques, specifically a multi-date supervised classification aproach, were used to develop a land cover map for an agricultural area near Fresno, California. Twenty-six land cover classes were identified, of which twenty classes were agricultural crops. High classification accuracies (greater than 80%) were attained for several classes, including cotton, grain, and vineyards. The primary products generated were 1:24,000, 1:100,000 and 1:250,000 scale maps of the classification and acreage summaries for all land cover classes within four alternate transmission line routes. Author

N83-15742*# Colorado Univ., Boulder. Dept. of Astro-Geophysics.

DATA USE INVESTIGATION FOR THE MAGNETIC FIELD SATELLITE (MAGSAT) MISSION: GEOMAGNETIC FIELD FORECASTING AND FLUID DYNAMICS OF THE CORE Final Project Report, 27 Dec. 1979 - 26 Nov. 1982

Edward R. Benton, Principal Investigator 8 Oct. 1982 28 p ERTS

(Contract NAS5-25957)

(E83-10098; NASA-CR-169675; NAS 1.26:169675) Avail: NTIS HC A03/MF A01 CSCL 08G

MAGSAT data were used to construct a variety of spherical harmonic models of the main geomagnetic field emanating from Earth's liquid core at poch 1980. These models were used to: (1) accurately determine the radius of Earth's core by a magnetic method, (2) calculate estimates, of the long-term ange of variation of geomagnetic Gauss coefficients; (3) establish a preferred truncation level for current spherical harmonic models of the main geomagnetic field from the core; (4) evaluate a method for taking account of electrical conduction in the mantle when the magnetic field is downward continued to the core-mantle boundary; and (5) establish that upwelling and downwelling of fluid motion at the top of the core is probably detectable, observationally. A fluid dynamics forecast model was not produced because of insufficient data. A.R.H.

N83-15743*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

COMPUTER PROGRAM DOCUMENTATION FOR THE PASTURE/RANGE CONDITION ASSESSMENT PROCESSOR

K. S. McIntyre and T. G. Miller, Principal Investigators Jul. 1982 46 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E83-10100; NASA-CR-167746; EW-L2-04340; JSC-18265; NAS 1.26:167746; LEMSCO-18627) Avail: NTIS HC A03/MF A01 CSCL 02C

The processor which drives for the RANGE software allows the user to analyze LANDSAT data containing pasture and rangeland. Analysis includes mapping, generating statistics, calculating vegetative indexes, and plotting vegetative indexes. Routines for using the processor are given. A flow diagram is included. A.R.H.

N83-15744*# Energy, Mines and Resources Canada, Ottawa (Ontario). Earth Physics Branch.

THE REDUCTION, VERIFICATION AND INTERPRETATION OF MAGSAT MAGNETIC DATA OVER CANADA Progress Report

R. L. Coles, Principal Investigator, G. V. Haines, G. Jansen vanBeek, J. K. Walker, and L. R. Newitt Nov. 1982 3 p Sponsored by NASA ERTS

(E83-10101; NASA-CR-169677; NAS 1.26:169677; PR-7) Avail: NTIS HC A02/MF A01 CSCL 05B

Consideration is being given to representing the magnetic field in the area 40 deg N to 83 deg N by means of functions in spherical coordinates. A solution to Laplace's equation for the magnetic potential over a restricted area was found, and programming and testing are currently being carried out. Magnetic anomaly modelling is proceeding. The program SPHERE, which was adapted to function correctly on the Cyber computer, is now operational, for deriving gravity and magnetic models in a spherical coordinate system. A.R.H.

N83-15745*# Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.

USE OF THERMAL INERTIA DETERMINED BY HCMM TO PREDICT NOCTURNAL COLD PRONE AREAS IN FLORIDA Progress Report, 16 Jun. - 15 Nov. 1982

L. H. Allen, Jr., Principal Investigator, Ellen Chen, J. D. Martsolf, P. H. Jones, T. N. Carlson, and G. DelValle 15 Nov. 1982 7 p ref ERTS

(Contract NAS5-26453)

(E83-10102; NASA-CR-169678; NAS 1.26:169678) Avail: NTIS HC A02/MF A01 CSCL 04B

Registered data sets were used to develop qualititative temperature and delta T maps of a band across north Florida and across south Florida for use with Carlson's boundary layer energy model balance model. Thermal inertia and moisture availability computations for north Florida are being used to investigate model sensitivity and to evaluate input parameters. Temperature differences of day-night HCMM overpasses clearly differentiate wetlands and uplands areas. A.R.H.

N83-15746*# Agricultural Research Service, Weslaco, Tex.

METHODS OF EDITING CLOUD AND ATMOSPHERIC LAYER AFFECTED PIXELS FROM SATELLITE DATA Final Report,

5 Dec. 1980 - 5 Jun. 1982
Paul R. Nixon, Principal Investigator, Craig L. Wiegand, Arthur J. Richardson, and Michael P. Johnson Nov. 1982 48 p refs Sponsored by NASA Original contains color imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20770. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E83-10103; NASA-CR-169679; NAS 1.26:169679) Avail: NTIS HC A03/MF A01 CSCL 05B

Practical methods of computer screening cloud-contaminated pixels from data of various satellite systems are proposed. Examples are given of the location of clouds and representative landscape features in HCMM spectral space of reflectance (VIS) vs emission (IR). Methods of screening out cloud affected HCMM are discussed. The character of subvisible absorbing-emitting atmospheric layers (subvisible cirrus or SCi) in HCMM data is considered and radiosonde soundings are examined in relation to the presence of SCi. The statistical characteristics of multispectral meteorological satellite data in clear and SCi affected areas are discussed. Examples in TIROS-N and NOAA-7 data from several states and Mexico are presented. The VIS-IR cluster screening method for removing clouds is applied to a 262, 144 pixel HCMM scene from south Texas and northeast Mexico. The SCi that remain after cluster screening are sited out by applying a statistically determined IR limit. A.R.H.

N83-15747*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
DEVELOPMENT OF A DATA MANAGEMENT FRONT END FOR USE WITH A LANDSAT BASED INFORMATION SYSTEM Final Report, Feb. 1981 - Jan. 1982
Brian J. Turner, Principal Investigator Jan. 1982 34 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS5-26468)
(E83-10104; NASA-CR-170461; NAS 1.26:170461) Avail: NTIS HC A03/MF A01 CSCL 05B

A user friendly front end was constructed to facilitate access to the LANDSAT mosaic data base supplied by JPL and to process both LANDSAT and ancillary data. Archieval and retrieval techniques were developed to efficiently handle this data base and make it compatible with requirements of the Pennsylvania Bureau of Forestry. Procedures are ready for: (1) forming the forest/nonforest mask in ORSER compressed map format using GSFC-supplied classification procedures; (2) registering data from a new scene (defoliated) to the mask (which may involve mosaicking if the area encompasses two LANDSAT scenes; (3) producing a masked new data set using the MASK program; (4) analyzing this data set to produce a map showing degrees of defoliation, output on the Versatec plotter; and (5) producing color composite maps by a diazo-type process. A.R.H.

N83-15748*# Phoenix Corp., McLean, Va.
GRAVSAT ERROR ANALYSIS BY MEANS OF GLOBAL SPECTRAL ANALYSES OF THE MARINE GEOID FROM SEASAT ALTIMETER DATA Final Report
29 Apr. 1982 38 p refs ERTS
(Contract NAS5-26579)
(E83-10105; NASA-CR-166819; NAS 1.26:166819) Avail: NTIS HC A03/MF A01 CSCL 08E

The geographical variability of short wavelength geoid power spectra (geoid roughness), was mapped for the world's oceans between latitudes 72 deg N and 72 deg S. A spectral analysis of SEASAT altimeter data, reduced to sea surface heights, was performed at 2 minute intervals for 15 consecutive days of the 3-day repeat orbit. The geoid roughness represented by these spectra for wavelengths shorter than about 220 km is separated from the total sea height variance and is displayed in the form of a global contour map. The global average geoid roughness is 32 cm RMS, varying from a high in excess of 2 m RMS near deep ocean trenches to a low of 2 cm RMS in the southeast Pacific near the East Pacific Rise. This average value agrees well with previous estimates based on gravimetry and GEOS-3 altimetry. In general, the smoothest areas in the marine geoid overlie relatively young seafloor adjacent mid-ocean spreading centers, where even short-wavelength topographic variations tend to be isostatically compensated. Author

N83-15749*# Utah Univ., Salt Lake City. Center for Remote Sensing and Cartography.
DETECTION OF ASPEN-CONIFER FOREST MIXES FROM LANDSAT DIGITAL DATA
Richard A. Jaynes and John A. Merola [1982] 30 p refs Sponsored by Dept. of Agriculture ERTS
(Grant NAGw-95)
(E83-10106; NASA-CR-169680; NAS 1.26:169680; CRSC-82-4) Avail: NTIS HC A03/MF A01 CSCL 08F

Aspen, conifer and mixed aspen/conifer forests were mapped for a 15-quadrangle study area in the Utah-Idaho Bear River Range using LANDSAT multispectral scanner data. Digital classification and statistical analysis of LANDSAT data allowed the identification of six groups of signatures which reflect different types of aspen/conifer forest mixing. Photo interpretations of the print symbols suggest that such classes are indicative of mid to late seral aspen forests. Digital print map overlays and acreage calculations were prepared for the study area quadrangles. Further field verification is needed to acquire additional information about the nature of the forests. Single date LANDSAT analysis should be a cost effective means to index aspen forests which are at least in the mid seral phase of conifer invasion. Since aspen canopies tend to obscure understory conifers for early seral forests, a second date analysis, using data taken when aspens are leafless, could provide information about early seral aspen forests. Author

N83-15750*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRAL CHARACTERIZATION OF THE LANDSAT-D MULTISPECTRAL SCANNER SUBSYSTEMS
Brian L. Markham, Principal Investigator and John L. Barker Jun. 1982 65 p refs Submitted for publication ERTS
(E83-10107; NASA-TM-83955; NAS 1.15:83955) Avail: NTIS HC A04/MF A01 CSCL 20F

Relative spectral response data for the multispectral scanner subsystems (MSS) to be flown on LANDSAT-D and LANDSAT-D backup, the protoflight and flight models, respectively, are presented and compared to similar data for the Landsat 1,2, and 3 subsystems. Channel-bychannel (six channels per band) outputs for soil and soybean targets were simulated and compared within each band and between scanners. The two LANDSAT-D scanners proved to be nearly identical in mean spectral response, but they exhibited some differences from the previous MSS's. Principal differences between the spectral responses of the D-scanners and previous scanners were: (1) a mean upper-band edge in the green band of 606 nm compared to previous means of 593 to 598 nm; (2) an average upper-band edge of 697 nm in the red band compared to previous averages of 701 to 710 nm; and (3) an average bandpass for the first near-IR band of 702-814 nm compared to a range of 693-793 to 697-802 nm for previous scanners. These differences caused the simulated D-scanner outputs to be 3 to 10 percent lower in the red band and 3 to 11 percent higher in the first near-IR band than previous scanners for the soybeans target. Otherwise, outputs from soil and soybean targets were only slightly affected. The D-scanners were generally more uniform from channel to channel within bands than previous scanners. Author

N83-15751*# Texas A&M Univ., College Station. Remote Sensing Center.
MICROWAVE REMOTE SENSING OF SOIL MOISTURE, VOLUME 1 Final Report
Marshall J. McFarland, Principal Investigator, Sidney W. Theis, Wesley D. Rosenthal, and Cheryl L. Jones Feb. 1982 144 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198

ERTS
(Grant NsG-5134)
(E83-10108; NASA-CR-166822; NAS 1.26:166822;
RSC-3458-129-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 08M

Multifrequency sensor data from NASA's C-130 aircraft were used to determine which of the all weather microwave sensors demonstrated the highest correlation to surface soil moisture over optimal bare soil conditions, and to develop and test techniques which use visible/infrared sensors to compensate for the vegetation effect in this sensor's response to soil moisture. The L-band passive microwave radiometer was found to be the most suitable single sensor system to estimate soil moisture over bare fields. The perpendicular vegetation index (PVI) as determined from the visible/infrared sensors was useful as a measure of the vegetation effect on the L-band radiometer response to soil moisture. A linear equation was developed to estimate percent field capacity as a function of L-band emissivity and the vegetation index. The prediction algorithm improves the estimation of moisture significantly over predictions from L-band emissivity alone. A.R.H.

N83-15752*# Utah Univ., Salt Lake City. Center for Remote Sensing and Cartography.
IDENTIFYING ENVIRONMENTAL FEATURES FOR LAND MANAGEMENT DECISIONS Semiannual Report
8 May 1981 32 p ref ERTS
(Grant NsG-7226)
(E83-10109; NASA-CR-169681; NAS 1.26:169681) Avail: NTIS HC A03/MF A01 CSCL 08B

The benefits of changes in management organization and facilities for the Center for Remote Sensing and Cartography in Utah are reported as well as interactions with and outreach to state and local agencies. Completed projects are described which studied (1) Unita Basin wetland/land use; (2) Davis County foothill development; (3) Farmington Bay shoreline fluctuation; (4) irrigation detection; and (5) satellite investigation of snow cover/mule deer relationships. Techniques developed for composite computer mapping, contrast enhancement, U-2 CIR/LANDSAT digital interface; factor analysis, and multivariate statistical analysis are described. A.R.H.

N83-15753*# Aster Consulting Associates, Binghamton, N.Y.
A REVIEW OF CROP CANOPY REFLECTANCE MODELS
Narendra S. Goel, Principal Investigator 1 Aug. 1982 55 p refs ERTS
(Contract NAS9-16505)
(E83-10110; NASA-CR-167716; NAS 1.26:167716) Avail: NTIS HC A04/MF A01 CSCL 02C

Various models for calculating crop canopy reflectance, in the visible and infrared wavelengths, from the optical and geometrical properties of a canopy and its constituents are reviewed. The radiative transfer equation is discussed as well as both analytical and numerical crop reflectance models which are manifestations of the solution of this equation. Recommendations are made for further work in modeling of canopy reflectance. Author

N83-15754*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
VERIFICATION OF LANDSAT IMAGERY FOR MORPHAMETRIC AND TOPOLOGICAL STUDIES OF DRAINAGE BASINS IN A SECTION OF THE WESTERN PLATEAU OF SAO PAULO STATE: TIETE-AGUAPEI WATERSHED M.S. Thesis [AVALIACAO DAS IMAGENS LANDSAT PARA ESTUDOS MORFOMETRI COS E TOPOLOGICOS DE BACIAS HIDROGRAFICAS, EM UMA AREA DO PLANALTO OCIDENTAL PAULISTA: INTERFLUVIO TIETE-AGUAPEI (FEIO)]
Nelson de Jesus Parada, Principal Investigator and Jose Carlos Godoy Camargo Jun. 1982 255 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E83-10111; NASA-CR-169695; NAS 1.26:169695;
INPE-2444-TDL/093) Avail: NTIS HC A12/MF A01 CSCL 08B

The potential of using LANDSAT MSS imagery for morphometric and topological studies of drainage basins was verified. Using Tiete and Aguapei watershed (Western Plateau) as the test site because of its homogeneous landscape. Morphometric variables collected for ten drainage basins include: circularity index; river density; drainage density; topographic texture; areal and index length; basin parameter; and main river length 1st order and 2nd order channel length. The topographical variables determined were: order; magnitude; bifuraction ratio; weighted bifuraction ratio; number of segments; number of linking; trajectory length; and topological diameter. Data were collected on topographical maps at the scale of 1:250,000 and 1:59,000 and on LANDSAT imagery at the scale of 1:250,000. The results which were summarized on tables for further analysis, show that LANDSAT imagery can supply the lack of topographic charts for drainage studies. Author

N83-15755*# Business and Technological Systems, Inc., Seabrook, Md.
GEOMAGNETIC MODELING BY OPTIMAL RECURSIVE FILTERING Final Report
Bruce P. Gibbs and Ronald H. Estes May 1981 119 p refs ERTS
(Contract NAS5-26250)
(E83-10112; NASA-CR-169696; NAS 1.26:169696;
BTS-FR-81-147) Avail: NTIS HC A06/MF A01 CSCL 08G

The results of a preliminary study to determine the feasibility of using Kalman filter techniques for geomagnetic field modeling are given. Specifically, five separate field models were computed using observatory annual means, satellite, survey and airborne data for the years 1950 to 1976. Each of the individual field models used approximately five years of data. These five models were combined using a recursive information filter (a Kalman filter written in terms of information matrices rather than covariance matrices.) The resulting estimate of the geomagnetic field and its secular variation was propogated four years past the data to the time of the MAGSAT data. The accuracy with which this field model matched the MAGSAT data was evaluated by comparisons with predictions from other pre-MAGSAT field models. The field estimate obtained by recursive estimation was found to be superior to all other models. Author

N83-15756*# Texas A&M Univ., College Station. Remote Sensing Center.
RANGELAND BIOMASS ESTIMATION DEMONSTRATION Final Report
R. W. Newton, Principal Investigator, W. E. Boyd, and B. V. Clark Feb. 1982 58 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS9-16369)
(E83-10113; NASA-CR-167634; NAS 1.26:167634;
RSC-4496-132) Avail: NTIS HC A04/MF A01 CSCL 02C

Because of their sensitivity to chlorophyll density, green leaf density, and leaf water density, two hand-held radiometers which have sensor bands coinciding with thematic mapper bands 3, 4, and 5 were used to calibrate green biomass to LANDSAT spectral ratios as a step towards using portable radiometers to speed up ground data acquisition. Two field reflectance panels monitored incoming radiation concurrently with sampling. Software routines were developed and used to extract data from uncorrected tapes of MSS data provided in NASA LANDSAT universal format. A LANDSAT biomass calibration curve estimated the range biomass over a four scene area and displayed this information spatially as a product in a format of use to ranchers. The regional biomass contour map is discussed. A.R.H.

N83-15757*# Kansas Univ., Lawrence. Space Technology Center.
THE APPLICATION OF REMOTE SENSING TO RESOURCE MANAGEMENT AND ENVIRONMENTAL QUALITY PROGRAMS IN KANSAS Annual Report, 1 Apr. 1981 - 31 Mar. 1982
B. G. Barr and E. A. Martinko, Principal Investigators Jul. 1982 234 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Grant NGL-17-004-024)
(E83-10114; NASA-CR-169697; NAS 1.26:169697) Avail: NTIS HC A11/MF A01 CSCL 05A

Capabilities to process data for state agencies in Kansas were upgraded through the vehicle of a low cost data processing system. Short term projects in which agencies identified areas of immediate needs, and longer terms projects, continued from previous years, are described including studies of Arkansas River irrigation; evaluation of rangeland in the Cimarron National Grassland; a model of the Walnut Creek watershed groundwater; selection of a pronghorn antelope release site; the establishment of a geographical data base for tax reassement in Finney County; a land use/land cover inventory and hazards assessment; and applied R & D in agricultural remote sensing. The topics discussed at a short course in remote sensing and publications are listed. A.R.H.

N83-15758*# Kansas Univ. Center for Research, Inc., Lawrence. Space Technology Center.
CROP-PHENOLOGY AND LANDSAT-BASED IRRIGATED LANDS INVENTORY IN THE HIGH PLAINS Interim Report, 1 Dec. 1980 - 31 Jan. 1981
E. A. Martinko, Principal Investigator, J. Poracsky, E. R. Kipp, and H. Krieger 31 Jan. 1981 80 p ERTS
(Grant NAG2-57)
(E83-10115; NASA-CR-169698; NAS 1.26:169698; IR-2) Avail: NTIS HC A05/MF A01 CSCL 02C

Crop calendars for 1979 and 1980 were investigated in support of an effort to develop techniques for mapping the High Plains aquifer region. Optimal LANDSAT image dates for 1980 were preliminarily identified based on ESS weekly crop weather reports and 1979 ESS agricultural statistics were entered into the computer. A questionnaire was compiled and sent to ASCS county agents with the approval of the Extension Directors in each state involved. Data from returning questionnaires were tabulated and development started on a set of computer programs to allow the preparation of computer assisted graphic displays of much of the collected data. A.R.H.

N83-15759*# Texas A&M Univ., College Station. Dept. of Mathematics.
PROCEEDINGS OF THE NASA WORKSHOP ON SURFACE FITTING
L. F. Guseman, Jr., Principal Investigator 1982 217 p refs Workshop held at College Station, Tex., 17-19 May 1982 ERTS
(Contract NAS9-16447)
(E83-10117; NASA-CR-167779; NAS 1.26:167779) Avail: NTIS HC A10/MF A01 CSCL 05B

Surface fitting techniques and their utilization are addressed. Surface representation, approximation, and interpolation are discussed. Along with statistical estimation problems associated with surface fitting. For individual titles, see N83-15760 through N83-15765.

N83-15760*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CROP PROPORTION ESTIMATION PROBLEMS IN AGRISTARS
Richard P. Heydorn *In* Texas A and M Univ. Proc. of the NASA Workshop on Surface Fitting 1982 p 7-26 ERTS (For primary document see N83-15759 06-43)
Avail: NTIS HC A10/MF A01 CSCL 02C

Some mathematical/statistical problems within the AgRISTARS program amendable to investigations involving the use of surface fitting techniques are overviewed. The Bayes and maximum likelihood rules, bias determination, regression estimators, parameter estimation, and classifier design are addressed. M.G.

N83-15761*# Texas A&M Univ., College Station. Dept. of Mathematics.
FITTING SURFACES TO SCATTERED DATA
Larry L. Schumaker *In its* Proc. of the NASA Workshop on Surface Fitting 1982 p 27-94 refs ERTS (For primary document see N83-15759 06-43)
Avail: NTIS HC A10/MF A01 CSCL 05B

A variety of numerical methods for fitting a function to data given at a set of points scattered throughout a domain in the plane are surveyed. Four classes of methods are discussed: (1) global interpolation; (2) local interpolation; (3) global approximation; and (4) local approximation. Also, two-stage methods and contouring are discussed. The surfaces constructed include polynomials, spline functions, and rational functions, among others. M.G.

N83-15762*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
C-1 SURFACE INTERPOLATION FOR SCATTERED DATA ON A SPHERE
Charles L. Lawson *In* Texas A and M Univ. Proc. of the NASA Workshop on Surface Fitting 1982 p 95-119 refs ERTS (For primary document see N83-15759 06-43)
Avail: NTIS HC A10/MF A01 CSCL 05B

An algorithm is described for constructing a smooth computable function, f, defined over the surface of a sphere and interpolating a set of n data values, u sub i, associated with n locations, P sub i, on the surface of the sphere. The interpolation function, f, will be continuous and have continuous first partial derivatives. The locations, p sub i, are not required to lie on any type of regular grid. M.G.

N83-15763*# Utah Univ., Salt Lake City. Dept. of Mathematics.
SURFACES: REPRESENTATION AND APPROXIMATION
R. E. Barnhill *In* Texas A and M Univ. Proc. of the NASA Workshop on Surface Fitting 1982 p 121-134 ref ERTS (For primary document see N83-15759 06-43)
(Grant NSF MCS 81-01854)
Avail: NTIS HC A10/MF A01 CSCL 05B

Schemes for the representation and approximation of surfaces, based on Coon's and triangular patches and blending are discussed. The necessary criteria/characteristics for resulting spaces are outlined. M.G.

N83-15764*# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
SURFACE FITTING WITH BIHARMONIC AND HARMONIC MODELS
Rolland L. Hardy *In* Texas A and M Univ. Proc. of the NASA Workshop on Surface Fitting 1982 p 135-146 refs ERTS (For primary document see N83-15759 06-43)
Avail: NTIS HC A10/MF A01 CSCL 05B

The physical and geometric interpretation of a surface fitting technique, multiquadric equations (MQ), is discussed. The relation of this method and its reciprocal form to biharmonic and harmonic techniques respectively, is pointed out. In both forms the solutions may be viewed as being numerical approximations of an integral equation in which an unknown density function is the physical source for disturbing potential (reciprocal-MQ) or elastic displacement (MQ). M.G.

N83-15765*# California Polytechnic State Univ., San Luis Obispo. Dept. of Computer Science.
BSPLASH: A THREE-STAGE SURFACE INTERPOLANT TO SCATTERED DATA
Thomas A. Foley *In* Texas A and M Univ. Proc. of the NASA Workshop on Surface Fitting 1982 p 147-178 refs ERTS (For primary document see N83-15759 06-43)
Avail: NTIS HC A10/MF A01 CSCL 05B

Given N distinct points (X sub i, Y sub i) and N real numbers Z sub i, BSPLASH constructs a function G (x, y) that satisfies G (x sub i, y sub i) = Z sub i for i = 1,..., N. This C(2) interpolant consists of a bicubic spline approximation and Shepard's bivariate interpolant. M.G.

N83-15766*# Texas A&M Univ., College Station. Dept. of Mathematics.
PROCEEDINGS OF THE NASA WORKSHOP ON IMAGE ANALYSIS
L. F. Guseman, Jr., Principal Investigator 1982 149 p refs

Workshop held in College Station, Tex., 28-30 Apr. 1982 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS9-16447)
(E83-10118; NASA-CR-167778; NAS 1.26:167778) Avail: NTIS HC A07/MF A01 CSCL 05B

Three major topics of image analysis are addressed: segmentation, shape and texture analysis, and structural analysis. For individual titles, see N83-15767 through N83-15773.

N83-15767*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Computer Science.
IMAGE SEGMENTATION SURVEY
Robert M. Haralick *In* Texas A and M Univ. Proc. of the NASA Workshop on Image Anal. 1982 p 7-16 refs ERTS (For primary document see N83-15766 06-43)
Avail: NTIS HC A07/MF A01 CSCL 05B

The methodologies and capabilities of image segmentation techniques are reviewed. Single linkage schemes, hybrid linkage schemes, centroid linkage schemes, histogram mode seeking, spatial clustering, and split and merge schemes are addressed.
M.G.

N83-15768*# Maryland Univ., College Park. Computer Vision Lab.
COOPERATIVE PROCESSES IN IMAGE SEGMENTATION
Larry S. Davis *In* Texas A and M Univ. Proc. of the NASA Workshop on Image Anal. 1982 p 17-50 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N83-15766 06-43)
Avail: NTIS HC A07/MF A01 CSCL 05B

Research into the role of cooperative, or relaxation, processes in image segmentation is surveyed. Cooperative processes can be employed at several levels of the segmentation process as a preprocessing enhancement step, during supervised or unsupervised pixel classification and, finally, for the interpretation of image segments based on segment properties and relations. M.G.

N83-15769*# Maryland Univ., College Park. Computer Science Center.
SHAPE AND TEXTURE
Azriel Rosenfeld *In* Texas A and M Univ. Proc. of the NASA Workshop on Image Anal. 1982 p 57-84 refs ERTS (For primary document see N83-15766 06-43)
Avail: NTIS HC A07/MF A01 CSCL 05B

Methods used to measure the geometrical properties of regions in a segmented image are discussed including the use of centroids, moments, and principle axes. In addition, statistical picture properties, particularly those which describe visual texture, are discussed. Gray level statistics, local property statistics, and autocorrelation and power spectrum are addressed. M.G.

N83-15770*# Florida Univ., Gainesville. Center for Information Research.
AUTOMATIC PHOTOINTERPRETATION VIA TEXTURE AND MORPHOLOGY ANALYSIS
Julius T. Tou *In* Texas A and M Univ. Proc. of the NASA Workshop on Image Anal. 1982 p 87-88 ERTS (For primary document see N83-15766 06-43)
Avail: NTIS HC A07/MF A01 CSCL 05B

Computer-based techniques for automatic photointerpretation based upon information derived from texture and morphology analysis of images are discussed. By automatic photointerpretation, is meant the determination of semantic descriptions of the content of the images by computer. To perform semantic analysis of morphology, a heirarchical structure of knowledge representation was developed. The simplest elements in a morphology are strokes, which are used to form alphabets. The alphabets are the elements for generating words, which are used to describe the function or property of an object or a region. The words are the elements for constructing sentences, which are used for semantic description of the content of the image. Photointerpretation based upon morphology is then augmented by textural information. Textural analysis is performed using a pixel-vector approach. M.G.

N83-15771*# Honeywell Systems and Research Center, Minneapolis, Minn.
FLIR TARGET SCREENING
Raj Aggarwal *In* Texas A and M Univ. Proc. of the NASA Workshop on Image Anal. 1982 p 89 ERTS (For primary document see N83-15766 06-43)
Avail: NTIS HC A07/MF A01 CSCL 20F

Methods for the segmentation and recognition of individual targets sensed with forward looking infrared detectors are discussed. Particular attention is given to an adaptive multi-scenario target screener. M.G.

N83-15772*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Computer Science.
STRUCTURAL ANALYSIS TECHNIQES FOR REMOTE SENSING
Linda G. Shapiro *In* Texas A and M Univ. Proc. of the NASA Workshop on Image Anal. 1982 p 91-132 refs ERTS (For primary document see N83-15766 06-43)
Avail: NTIS HC A07/MF A01 CSCL 05B

The structural analysis of remotely sensed imagery is defined and basic techniques for implementing the process are described. Structural analysis uses knowledge of the properties of an entity, its parts and their relationships, and the relationships in which it participates at a higher level to locate and recognize objects in a visual scene. The representation of structural knowledge, the development of algorithms for using the knowledge to help analyze an image, and techniques for storage and retrieval of relational models are addressed. M.G.

N83-15773*# Illinois Univ., Urbana. Coordinated Science Lab.
DETERMINING 3-D MOTION AND STRUCTURE FROM IMAGE SEQUENCES
T. S. Huang *In* Texas A and M Univ. Proc. of the NASA Workshop on Image Anal. 1982 p 134-149 refs ERTS (For primary document see N83-15766 06-43)
Avail: NTIS HC A07/MF A01 CSCL 05B

A method of determining three-dimensional motion and structure from two image frames is presented. The method requires eight point correspondences between the two frames, from which motion and structure parameters are determined by solving a set of eight linear equations and a singular value decomposition of a 3x3 matrix. It is shown that the solution thus obtained is unique.
M.G.

N83-15774*# Texas A&M Univ., College Station. Dept. of Mathematics.
PROCEEDINGS OF THE NASA WORKSHOP ON DENSITY ESTIMATION AND FUNCTION SMOOTHING
L. F. Guseman, Jr., Principal Investigator 1982 491 p refs Workshop held at College Station, Tex., 11-13 Mar. 1982 ERTS (Contract NAS9-16447)
(E83-10119; NASA-CR-167780; NAS 1.26:167780) Avail: NTIS HC A21/MF A01 CSCL 05B

Statistical model identification techniques being developed to provide workable solutions to problems in density estimation and function smoothing are examined. For individual titles, see N83-15775 through N83-15789.

N83-15775*# McGill Univ., Montreal (Quebec). School of Computer Science.
TOPICS IN GLOBAL CONVERGENCE OF DENSITY ESTIMATES
Luc Devroye *In* Texas A and M Univ. Proc. of the NASA Workshop on Density Estimation and Function Smoothing 1982 p 9-19 refs Sponsored by Natural Sciences and Engineering Research Council ERTS (For primary document see N83-15774 06-43)
Avail: NTIS HC A21/MF A01 CSCL 05B

The problem of estimating a density f on R sup d from a sample Xz(1),...,X(n) of independent identically distributed random

vectors is critically examined, and some recent results in the field are reviewed. The following statements are qualified: (1) For any sequence of density estimates f(n), any arbitrary slow rate of convergence to 0 is possible for E(integral/f(n)-f|); (2) In theoretical comparisons of density estimates, integral/f(n)-f/ should be used and not integral/f(n)-f/sup p, p > 1; and (3) For most reasonable nonparametric density estimates, either there is convergence of integral/f(n)-f/ (and then the convergence is in the strongest possible sense for all f), or there is no convergence (even in the weakest possible sense for a single f). There is no intermediate situation. Author

N83-15776*# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
CROSS-VALIDATION FOR DENSITIES AND REGRESSIONS
Stuart Geman *In* Texas A and M Univ. Proc. of the NASA Workshop on Density Estimation and Function Smoothing 1982 p 20-31 refs ERTS (For primary document see N83-15774 06-43)
(Contract DAAG29-80-K-0006; Grant AF-AFOSR-3514-78)
Avail: NTIS HC A21/MF A01 CSCL 05B

Virtually all nonparametric (infinite dimensional) problems require the choice of a smoothing parameter. It is natural to attempt to use the data to guide the choice of this parameter. The most widely applicable data driven technique is cross validation. The method of cross validation is introduced and results are presented which establish consistency for certain cross validated density estimators and consistency as well as asymptotic normality for rigid regression. A.R.H.

N83-15777*# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
CHARACTERIZATION OF A MAXIMUM-LIKELIHOOD NONPARAMETRIC DENSITY ESTIMATOR OF KERNEL TYPE
Stuart Geman and Donald E. McClure *In* Texas A and M Univ. Proc. of the NASA Workshop on density Estimation and Function Smoothing 1982 p 38-47 refs ERTS (For primary document see N83-15774 06-43)
(Contract DAAG-80-K-0006; Grant AF-AFOSR-3514-78)
Avail: NTIS HC A21/MF A01 CSCL 05B

Kernel type density estimators calculated by the method of sieves. Proofs are presented for the characterization theorem: Let x(1), x(2),...x(n) be a random sample from a population with density f(0). Let sigma > 0 and consider estimators f of f(0) defined by (1). A.R.H.

N83-15778*# Wisconsin Univ., Madison. Dept. of Statistics.
REMOTE SENSING OF TEMPERATURE PROFILES IN THE ATMOSPHERE
Finbarr OSullivan *In* Texas A and M Univ. Proc. of the NASA Workshop on Density Estimation and Function Smoothing 1982 p 48-59 refs ERTS (For primary document see N83-15774 06-43)
(Contract DAAG29-80-K-0042)
Avail: NTIS HC A21/MF A01 CSCL 04B

Methods of regularized and generalized cross validation can be used to estimate the atmosphere's temperature, moisture, and wind structure from a finite number m noisy measurements by meteorological satellites on the intensity of upwelling radiation in selected channel frequencies. The inversion of the equation of radiative transfer is discussed for data obtained by TIROS N satellite. A.R.H.

N83-15779*# Texas A&M Univ., College Station. Inst. of Statistics.
QUANTILES, PARAMETRIC-SELECT DENSITY ESTIMATION, AND BI-INFORMATION PARAMETER ESTIMATORS
Emanuel Parzen *In* Texas A and M Univ. Proc. of the NASA Workshop on Density Estimation and Function Smoothing 1982 p 60-84 refs ERTS (For primary document see N83-15774 06-43)
(Contract DAAG29-80-C-0070)
Avail: NTIS HC A21/MF A01 CSCL 05B

A quantile-based approach to statistical analysis and probability modeling of data is presented which formulates statistical inference problems as functional inference problems in which the parameters to be estimated are density functions. Density estimators can be non-parametric (computed independently of model identified) or parametric-select (approximated by finite parametric models that can provide standard models whose fit can be tested). Exponential models and autoregressive models are approximating densities which can be justified as maximum entropy for respectively the entropy of a probability density and the entropy of a quantile density. Applications of these ideas are outlined to the problems of modeling: (1) univariate data; (2) bivariate data and tests for independence; and (3) two samples and likelihood ratios. It is proposed that bi-information estimation of a density function can be developed by analogy to the problem of identification of regression models. Author

N83-15780*# Houston Univ., Tex. Dept. of Mathematics.
CONSISTENCY AND OTHER LARGE SAMPLE PROPERTIES OF MAXIMUM LIKELIHOOD ESTIMATES OF MIXTURE PARAMETERS
Charles Peters *In* Texas A and M Univ. Proc. of the NASA Workshop on Density Estimation and Function Smoothing 1982 p 85-101 refs ERTS (For primary document see N83-15774 06-43)
(Contract NAS9-14689)
Avail: NTIS HC A21/MF A01 CSCL 05B

The strong consistency, asymptotic normality, and asymptotic efficiency of maximum likelihood estimates of the parameters in a finite mixture of multivariate distributions are discussed as well as the asymptotic theory of some hypothesis tests for such mixtures. Author

N83-15781*# California Univ., San Diego, La Jolla.
SMOOTHING SPLINES: REGRESSION, DERIVATIVES AND DECONVOLUTION
John Rice and Murray Rosenblatt *In* Texas A and M Univ. Proc. of the NASA Workshop on Density Estimation and Function smoothing 1982 p 102-141 refs ERTS (For primary document see N83-15774 06-43)
(Contract N00014-81-K-0003; Grant NSF MCS-79-01800)
Avail: NTIS HC A21/MF A01 CSCL 05B

The statistical properties of a cubic smoothing spline and its derivative are analyzed. It is shown that unless unnatural boundary conditions hold, the integrated squared bias is dominated by local effects near the boundary. Similar effects are shown to occur in the regularized solution of a translation-kernel intergral equation. These results are derived by developing a Fourier representation for a smoothing spline. Author

N83-15782*# Texas Univ., El Paso. Dept. of Mathematical Sciences.
CONSIDERATIONS IN CROSS-VALIDATION TYPE DENSITY SMOOTHING WITH A LOOK AT SOME DATA
Eugene F. Schuster *In* Texas A and M Univ. Proc. of the NASA Workshop on Density Estimation and Function Smoothing 1982 p 142-164 refs ERTS (For primary document see N83-15774 06-43)
Avail: NTIS HC A21/MF A01 CSCL 05B

Experience gained in applying nonparametric maximum likelihood techniques of density estimation to judge the comparative quality of various estimators is reported. Two invariate data sets of one hundered samples (one Cauchy, one natural normal) are considered as well as studies in the multivariate case. A.R.H.

N83-15783*# Rice Univ., Houston, Tex.
REVIEW OF SOME RESULTS IN BIVARIATE DENSITY ESTIMATION
David W. Scott *In* Texas A and M Univ. Proc. of the NASA Workshop on Density Estimation and Function Smoothing 1982 p 165-194 refs ERTS (For primary document see N83-15774 06-43)
(Contract DAAG29-82-K-0014)
Avail: NTIS HC A21/MF A01 CSCL 05B

Results are reviewed for choosing smoothing parameters for some bivariate density estimators. Experience gained in comparing

the effects of smoothing parameters on probability density estimators for univariate and bivariate data is summarized. A.R.H.

N83-15784*# Bath Univ. (England). School of Mathematics.
A BOOTSTRAP APPROACH TO BUMP HUNTING
B. W. Silverman *In* Texas A and M Univ. Proc. of the NASA Workshop on Density Estimation and Function Smoothing 1982 p 195-213 refs ERTS (For primary document see N83-15774 06-43)
Avail: NTIS HC A21/MF A01 CSCL 05B

An important question in cluster analysis and pattern recognition is the determination of the number of clusters into which a given population should be divided. Frequently, particularly when certain specific clustering methods are being used, the number of clusters is taken to be equal to the number of modes, or local maxima, in the probability density function underlying the given data set. The use of kernal density estimates in mode estimation is discussed. The test statistic to be used is defined and a bootstrap technique for assessing significance is given. An illustrative application is followed by an examination of the asymptotic behavior of the test statistic. A.R.H.

N83-15785*# Rice Univ., Houston, Tex.
A DATA BASED RANDOM NUMBER GENERATOR FOR A MULTIVARIATE DISTRIBUTION (USING STOCHASTIC INTERPOLATION)
James R. Thompson and Malcolm S. Taylor (Ballistic Research Lab.) *In* Texas A and M Univ. Proc. of the NASA Workshop on Density Estimation and Function Smoothing 1982 p 214-225 refs Submitted for publication ERTS (For primary document see N83-15774 06-43)
(Contract DAAG29-82-K-0014)
Avail: NTIS HC A21/MF A01 CSCL 12A

Let X be a K-dimensional random variable serving as input for a system with output Y (not necessarily of dimension k). given X, an outcome Y or a distribution of outcomes G(Y/X) may be obtained either explicitly or implicity. The situation is considered in which there is a real world data set [X sub j] sub = 1 (n) and a means of simulating an outcome Y. A method for empirical random number generation based on the sample of observations of the random variable X without estimating the underlying density is discussed. Author

N83-15786*# Tulsa Univ., Okla. Dept. of Mathematical Sciences.
MIXTURE DENSITIES, MAXIMUM LIKELIHOOD, AND THE EM ALGORITHM
Richard A. Redner and Homer F. Walker (Houston Univ., Tex.) *In* Texas A and M Univ. Proc. of the NASA Workshop on Density Estimation and Function Smoothing 1982 p 226-342 refs ERTS (For primary document see N83-15774 06-43)
Avail: NTIS HC A21/MF A01 CSCL 12A

The problem of estimating the parameters which determine a mixture density is reviewed as well as maximum likelihood estimation for it. A particular iterative procedure for numerically approximating maximum likelihood estimates for mixture density problems is considered. This EM algorithm, is a specialization to the mixture density context of a general algorithm of the same name used to approximate maximum likelihood estimates for incomplete data problems. The formulation and theoretical and practical properties of the EM algorithm for mixture densities are discussed focussing in particular on mixtures of densities from exponential families. A.R.H.

N83-15787*# Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
REGRESSION METHODS FOR SPATIAL DATA
Sidney J. Yakowitz and F. Szidarovszky *In* Texas A and M Univ. Proc. of the NASA Workshop on Density Estimation and Function Smoothing 1982 p 343-385 refs ERTS (For primary document see N83-15774 06-43)
(Grants NSF ENG-78-12184; NSF ENG-76-20280; NSF ENG-78-07358; NSF CME-79-05010)
Avail: NTIS HC A21/MF A01 CSCL 12A

The kriging approach, a parametric regression method used by hydrologists and mining engineers, among others also provides an error estimate the integral of the regression function. The kriging method is explored and some of its statistical characteristics are described. The Watson method and theory are extended so that the kriging features are displayed. Theoretical and computational comparisons of the kriging and Watson approaches are offered. A.R.H.

N83-15788*# Wisconsin Univ., Madison. Dept. of Statistics.
ESTIMATION OF DIVERGENCE AND VORTICITY USING MULTIDIMENSIONAL SMOOTHING SPLINES
James G. Wendelberger *In* Texas A and M Univ. Proc. of the NASA Workshop on Density Estimation and Function Smoothing 1982 p 386-406 refs ERTS (For primary document see N83-15774 06-43)
(Grant NAG5-126; Contract N00014-77-C-0675)
Avail: NTIS HC A21/MF A01 CSCL 12A

Laplacian smoothing splines, smoothing splines on the sphere, and smoothing pseudo splines on the sphere are presented. The method of generalized cross validation to choose the smoothing parameter is described. These methods are applied to estimate divergence and vorticity of the atmosphere from wind speed and wind direction. Author

N83-15789*# Wisconsin Univ., Madison. Dept. of Statistics.
THE COMPUTATION OF LAPLACIAN SMOOTHING SPLINES WITH EXAMPLES
James G. Wendelberger *In* Texas A and M Univ. Proc. of the NASA Workshop on Density Estimation and Function Smoothing 1982 p 407-474 refs ERTS (For primary document see N83-15774 06-43)
(Grant NAG5-128; Contract N00014-77-C-0675)
(TR-648) Avail: NTIS HC A21/MF A01 CSCL 12A

Laplacian smoothing splines (LSS) are presented as generalizations of graduation, cubic and thin plate splines. The method of generalized cross validation (GCV) to choose the smoothing parameter is described. The GCV is used in the algorithm for the computation of LSS's. An outline of a computer program which implements this algorithm is presented along with a description of the use of the program. Examples in one, two and three dimensions demonstrate how to obtain estimates of function values with confidence intervals and estimates of first and second derivatives. Probability plots are used as a diagnostic tool to check for model inadequacy. Author

N83-15790*# Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering.
REMOTE SENSING PROGRAM Semiannual Status Report, 1 Jun. - 30 Nov. 1982
Warren R. Philipson, Principal Investigator, Ta Liang, and William D. Philpot Jan. 1983 261 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Grant NGL-33-010-171)
(E83-10120; NASA-CR-169723; NAS 1.26:169723) Avail: NTIS HC A12/MF A01 CSCL 05B

Field spectroradiometric and airborne multispectral scanner data were related to vineyard yield and other agronomic variables in an attempt to determine the optimum wavelengths for yield prediction modeling. Reflections between vine canopy reflectance and several management practices were also considered. Spectral analysis of test vines found that, although some correlations with vine yield were significant, they were inadequate for producing a yield prediction model. The findings also indicate that the vines examined through the field spectroradiometers were not truly representative. Geologic linears identified from aerial photographys, LANDSAT images, and maps were compared to gas well locations in three New York' counties. Correlations were found between the dominant trends in regional liners and gas field boundaries and trends. Other projects being conducted under the grant include determining vegetable acreage in mucklands, site selection for

windmills, spectral effects of sulfur dioxide, and screening tomato seedlings for salt tolerance. A.R.H.

N83-15791*# EROS Data Center, Sioux Falls, S. Dak.
LANDSAT 4 INVESTIGATIONS OF THEMATIC MAPPER AND MULTISPECTRAL SCANNER APPLICATIONS Quarterly Report
Donald T. Lauer, Principal Investigator 30 Dec. 1982 3 p Sponsored by NASA ERTS
(E83-10121; NASA-CR-169724; NAS 1.26:169724) Avail: NTIS HC A02/MF A01 CSCL 05B

Initial data screening, data handling and program testing were completed on the four-band Detroit scene and the seven-band northeast Arkansas scene. Data were received in early December for one primary eastern test site (Washington, D.C.) and one secondary eastern test site (Allegheny National Forest). A comprehensive digital data base was built for a portion of the Black Hills test site and is composed of historic LANDSAT MSS data; elevation, slope, and aspect data; land cover data; geologic data; thematic mapper simulator data; and digitized high altitude aircraft data. The thematic mapper and multispectral scanner data of the Washington area were resampled at 25 and 50 meters respectively, with map projection to UTM grid. A.R.H.

N83-15792*# EROS Data Center, Sioux Falls, S. Dak.
LANDSAT 3 RETURN BEAM VIDICON RESPONSE ARTIFACTS: A REPORT ON RBV PHOTOGRAPHIC PRODUCT CHARACTERISTICS AND QUALITY CODING SYSTEM
Bill P. Clark Aug. 1981 14 p Prepared in cooperation with Computer Sciences-Technicolor Associates, Greenbelt, Md. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E83-10122; NASA-CR-169725; NAS 1.26:169725) Avail: NTIS HC A02/MF A01 CSCL 05B

Analysis of large volumes of LANDSAT 3 RBV digital data that were converted to photographic form led to the firm identification of several visible artifacts (objects or structures not normally present, but producted by an external agency or action) in the imagery. These artifacts were identified, categorized, and traced directly to specific sensor response characteristics. None of these artifacts is easily removed and all cases remain under active study of possible future enhancement. The seven generic categories of sensor response artifacts identified to date include: (1) shading and stairsteps; (2) corners out of focus; (3) missing reseaus; (4) reseau distortion and data distortion; (5) black vertical line; (6) grain effect; and (7) faceplate contamination. An additional category under study, but not yet determined to be caused by sensor response, is a geometric anomaly. Examples of affected imagery are presented to assist in distinguishing between image content and innate defects caused by the sensor system. A.R.H.

N83-15793*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
FORTRAN IMPLEMENTATION OF FRIEDMAN'S TEST FOR SEVERAL RELATED SAMPLES
S. A. Davidson Feb. 1982 25 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E83-10123; NASA-CR-169726; SM-L2-04234; JSC-17816; NAS 1.26:169726; LEMSCO-17502) Avail: NTIS HC A02/MF A01 CSCL 02C

The FRIEDMAN program is a FORTRAN-coded implementation of Friedman's nonparametric test for several related samples with one observation per treatment/-block combination, or as it is sometimes called, the two-way analysis of variance by ranks. The FRIEDMAN program is described and a test data set and its results are presented to aid potential users of this program.Author

N83-15794*# Environmental Systems Research Inst., Redlands, Calif.
CIRSS VERTICAL DATA INTEGRATION, SAN BERNARDINO COUNTY STUDY PHASES 1-A, 1-B Annual Report
Jerald Christenson and Russell Michel, Principal Investigators Aug. 1981 251 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS2-10741)
(E83-10124; NASA-CR-166355; NAS 1.26:166355) Avail: NTIS HC A12/MF A01 CSCL 05B

User needs, data types, data automation, and preliminary applications are described for an effort to assemble a single data base for San Bernardino County from data bases which exist at several administrative levels. Each of the data bases used was registered and converted to a grid-based data file at a resolution of 4 acres and used to create a multivariable data base for the entire study area. To this data base were added classified LANDSAT data from 1976 and 1979. The resulting data base thus integrated in a uniform format all of the separately automated data within the study area. Several possible interactions between existing geocoded data bases and LANDSAT data were tested. The use of LANDSAT to update existing data base is to be tested. A.R.H.

N83-15795*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ANALYSIS OF THE CHARACTERISTICS APPEARING IN LANDSAT MULTISPECTRAL IMAGES IN THE GEOLOGICAL STRUCTURAL MAPPING OF THE MIDWESTERN PORTION OF THE RIO GRANDE DO SUL SHIELD M.S. Thesis - 25 Mar. 1982 [ANALISE DAS CARACTERISTICAS APRESENTADAS EM IMAGENS MULTIESPECTRAIS DO SATELITE LANDSAT NO MAPEAMENTO GEOLOGICO-ESTRUTURAL DA PORCAO CENTRO - OESTE DO ESCUDO SUL-RIOGRANDENSE]
Nelson de Jesus Parada, Principal Investigator and Tomoyuki Ohara Sep. 1982 362 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E83-10126; NASA-CR-169728; NAS 1.26:169728;
INPE-2524-TDL/100) Avail: NTIS HC A16/MF A01 CSCL 08G

The central-western part of Rio Grande do Sul Shield was geologically mapped to test the use of MSS-LANDSAT data in the study of mineralized regions. Visual interpretation of the images a the scale of 1:500,000 consisted, in the identification and analysis of the different tonal and textural patterns in each spectral band. After the structural geologic mapping of the area, using visual interpretation techniques, the statistical data obtained were evaluated, specially data concerning size and direction of fractures. The IMAGE-100 system was used to enlarge and enhance certain imagery. The LANDSAT MSS data offer several advantages over conventional white and black aerial photographs for geological studies. Its multispectral characteristic (band 6 and false color composition of bands 4, 5 and 7 were best suitable for the study). Coverage of a large imaging area of about 35,000 sq km, giving a synoptical view, is very useful for perceiving the regional geological setting. A.R.H.

N83-15796*# Environmental Systems Research Inst., Redlands, Calif.
CIRSS VERTICAL DATA INTEGRATION, SAN BERNARDINO STUDY
William Hodson, Jerrold Christenson, and Russel Michel, Principal Investigators Jun. 1982 317 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS2-10741)
(E83-10127; NASA-CR-166373; NAS 1.26:166373) Avail: NTIS HC A14/MF A01 CSCL 05B

The creation and use of a vertically integrated data base, including LANDSAT data, for local planning purposes in a portion of San Bernardino County, California are described. The project illustrates that a vertically integrated approach can benefit local users, can be used to identify and rectify discrepancies in various data sources, and that the LANDSAT component can be effectively used to identify change, perform initial capability/suitability

modeling, update existing data, and refine existing data in a geographic information system. Local analyses were developed which produced data of value to planners in the San Bernardino County Planning Department and the San Bernardino National Forest staff. Author

N83-15797*# Hughes Aircraft Co., Los Angeles, Calif. Space and Communications Group.
MSS D MULTISPECTRAL SCANNER SYSTEM Final Report, Apr. 1978 - Nov. 1981
A. M. Lauletta, R. L. Johnson, and K. L. Brinkman, Principal Investigators Apr. 1982 502 p refs ERTS
(Contract NAS5-25050)
(E83-10128; NASA-CR-170457; NAS 1.26:170457; HAC-E1966)
Avail: NTIS HC A22/MF A01 CSCL 05B

The development and acceptance testing of the 4-band Multispectral Scanners to be flown on LANDSAT D and LANDSAT D Earth resources satellites are summarized. Emphasis is placed on the acceptance test phase of the program. Test history and acceptance test algorithms are discussed. Trend data of all the key performance parameters are included and discussed separately for each of the two multispectral scanner instruments. Anomalies encountered and their resolutions are included. Author

N83-15798# Geological Survey, Westernport, Md.
WATER-DATA PROGRAM OF THE US GEOLOGICAL SURVEY
Bruce K. Gilbert and Thomas J. Buchanan 1982 19 p refs
(USGS-Circ-863; LC-82-6000102) Avail: NTIS HC A02/MF A01

The U.S. Geological Survey is the principal Federal agency responsible for the collection of hydrologic data needed for the planning, development, use, and management of the Nation's water resources. These data are the foundation necessary for conducting analytical and interpretive appraisals describing the occurrence and availability of surface and ground waters and their physical, chemical, and biological characteristics. The data are likewise required for basic and problem-oriented research in hydraulics, hydrology, and related fields. Hydrologic data collection by the Geological Survey began in 1888. Current operations include about 17,000 stations for collection of river, lake, and reservoir data; about 27,000 wells for collection of ground-water data; and almost 17,000 sites for collection of water-quality information. These activities, the means by which the data are made available, and how the program is coordinated with other agencies are desribed. Author

N83-15799# Scripps Institution of Oceanography, La Jolla, Calif. Shore Processes Lab.
INFRARED SATELLITE DATA FROM THE FIRST COASTAL OCEAN DYNAMICS EXPERIMENT, MARCH - JULY 1981
Kathryn A. Kelly Jul. 1981 60 p refs
(Contracts N00014-75-C-0300; N00014-80-C-0440)
(AD-A120068; SIO-REF-82-15) Avail: NTIS HC A04/MF A01 CSCL 08/10

As part of the Coastal Ocean Dynamics Experiment infrared images from the weather satellite NOAA-6 were collected from late March to mid-July 1981. Images which met certain quality criteria were registered to a common grid and were screened to eliminate data which were cloud-contaminated. Infrared images yield approximate sea-surface temperature maps via the blackbody relationship. This report contains photographs of the digital images and a brief description of the processing techniques which were used. Author (GRA)

N83-15800# Defense Mapping Agency Aerospace Center, St. Louis, Mo.
OVERVIEW OF AUTOMATED CARTOGRAPHY EFFORTS AT DMAAC Interim Report, Jan. 1981 - Jan. 1982
Dennis P. Franklin and Garry L. Holmes Sep. 1982 15 p refs
(AD-A120801) Avail: NTIS HC A02/MF A01 CSCL 08/2

The application of computer and computer assisted techniques to support current and future (thru 1988) requirements for chart production at the Defense Mapping Agency Aerospace Center (DMAAC) is discussed. Topics discussed include: Digital Paneling (computer assisted technique for reducing large scale map source to a smaller control projection); computer assisted chart symbolization for chart products, Digital Landmass System (DLMS), a data base containing Digital Terrain Elevation Data (DTED) and Digital Feature Analysis Data (DFAD) to support charting requirements and the computer generation of relief information from DTED data. Control, data collection, editing, chart compilation, chart revision, color separation, symbolization, and printing can be enhanced or accomplished by automated processes. Also considered is the development and continual evaluation of a Digital Cartographic Applications Data Base (DCAD) to provide this Center with a capability to support advanced digital mapping requirements. The DTED and DFAD data currently produced by DMAAC are used to support advanced aircraft simulators and navigation systems requirements. GRA

N83-15801# Sandia Labs., Albuquerque, N. Mex.
MATERIAL PROPERTIES OF GREEN RIVER OIL SHALE
Laurence S. Costin Oct. 1981 40 p refs
(Contract DE-AC04-76DP-00789)
(DE82-003271; SAND-81-1457) Avail: NTIS HC A03/MF A01

A compilation of material property data on Green River (Piceance Basin) oil shale is presented. It is intended to provide a baseline of data to support various thermomechanical modeling efforts in progress. The data, presented in tabular form, are divided into three categories: elastic properties, failure properties and thermal properties. Within each category, the data are listed by kerogen content and test condition (confining pressure, temperature, etc.). Summaries of some of the important features of the elastic and failure properties of oil shale are presented in graphical form. DOE

N83-15802# Mound Lab., Miamisburg, Ohio.
PHYSICAL AND CHEMICAL CHARACTERIZATION OF DEVONIAN GAS SHALE Quarterly Status Report, 1 Apr. - 30 Jun. 1981
R. E. Zielinski and E. Stacy 1981 51 p
(Contract DE-AC04-76DP-00053)
(DE82-002560; MLM-MU-81-66-0012; MLM-EGSP-TPR-Q-018)
Avail: NTIS HC A04/MF A01

Organic carbon contents were determined for samples from the OH-9 and NY-5 wells. The average total organic content for each well was 2.51 wt %, respectively. Visual kerogen assessments were also completed for the OH-9 and NY-5 wells. The average values for the total hydrocarbon yield, volatile hydrocarbon content, and Peak II maximum temperature were 0.94 wt %, 1688 ppM, and 459 deg C for OH-9. The samples from NY-5 averaged 0.22 wt % hydrocarbon, with approximately 77% of the total derived from Peak II production. The average vitrinite reflectance values for each well were 0.44 and 1.28, respectively suggesting an immature shale in OH-9 and a mature shale in NY-5. The bulk samples were predominately clay (42 to 45%), pyrite (12 to 26%), and quartz (28 to 36%) for OH-9, while the NY-5 samples contained clay (31 to 40%), pyrite (11 to 32%), and quartz (19 to 29%). DOE

N83-15803# Department of Energy, Bartlesville, Okla. Energy Technology Center.
CONTRACTS FOR FIELD PROJECTS AND SUPPORTING RESEARCH ON ENHANCED OIL RECOVERY AND IMPROVED DRILLING TECHNOLOGY Progress Review for quarter ending 30 Jun. 1981
Bill Linville, ed. Sep. 1981 142 p refs
(DE82-002598; DOE/BETC-81/3; PR-27) Avail: NTIS HC A07/MF A01

Reports are presented of contracts for field projects and supporting research on chemical flooding, carbon dioxide injection, thermal/heavy oil, as well as for the following areas of research: resource assessment technology; extraction technology; environmental; microbial enhanced oil recovery; improved drilling technology; and general supporting research. DOE

N83-15804# Pacific Northwest Lab., Richland, Wash.
SUBSURFACE HYDROLOGIC MONITORING TO EVALUATE CONTAMINANT MIGRATION: REQUIREMENTS AND SOLUTIONS
R. W. Nelson 1981 18 p refs Presented at the ORNL Symp. on the Environ. and Solid Wastes: Characterization, treatment, and disposal, Gatlinburg, Tenn., 4 Oct. 1981
(Contract DE-AC06-76RI-01830)
(DE82-003849; PNL-SA-9923; CONF-811060-2) Avail: NTIS HC A02/MF A01

Providing adequate subsurface monitoring for solid-waste treatment and disposal facilities involves a variety of complexities, many of which are due to the diversity of the waste forms and of the geologic and hydrologic settings encountered. An adequate and cost-effective evaluation of ground-water quality under such diverse conditions requires the coordination of a variety of technical disciplines and analytic methods. The purpose of this discussion is to: (1) consider the relationship of monitoring and the more detailed subsurface environmental performance assessments; (2) show how subsurface monitoring is best planned and organized within the framework of the overall environmental performance assessment objectives; and (3) explain the requirements and background needed for environmental evaluations of solid-waste treatment facilities and disposal sites. DOE

N83-15714# Ruhr Univ., Bochum (West Germany). Inst. of Konstruktiver Ingenieurbau.
EXPERIENCES AND INVESTIGATIONS USING GAP FREEZING TO CONTROL GROUND WATER FLOW
Heinz-Bernd Einck and Albert Weiler *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 193-204 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/8

N83-15728# Deilmann-Haniel G.m.b.H., Dortmund (West Germany).
GROUND FREEZING APPLICATIONS IN UNDERGROUND MINING CONSTRUCTION
Bernd Braun and William R. Nash (Frontier-Kemper Constructors) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 319-326 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/9

N83-15729# Kentucky Univ., Lexington. Dept. of Mining Engineering.
CONTROL OF FREEZING PROCESS ON EXAMPLE OF DEEP SHAFTS SUNKEN FOR POLISH COPPER MINES
Kot F. Unrug *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 327-336 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/9

N83-15730# Shaktspetsstroy, Moscow (USSR).
EMPLOYMENT OF ROCK FREEZING TECHNIQUES FOR SINKING DEEP MINE SHAFTS
I. F. Losj, I. N. Florov, Yu. A. Lownin, and V. M. Varenishev *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 337-348 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/9

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N83-15805*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CATALYTIC COMBUSTION WITH STEAM INJECTION
David N. Anderson and Robert R. Tacina 1982 15 p refs Presented at the Joint Power Generation Conf., Denver, 17-21 Oct. 1982; sponsored by ASME
(NASA-TM-82923; E-1315; NAS 1.15:82923) Avail: NTIS HC A02/MF A01 CSCL 10B

The effects of steam injection on (1) catalytic combustion performance, and (2) the tendency of residual fuel to burn in the premixing duct upstream of the catalytic reactor were determined. A petroleum residual, no. 2 diesel, and a blend of middle and heavy distillate coal derived fuels were tested. Fuel and steam were injected together into the preheated airflow entering a 12 cm diameter catalytic combustion test section. The inlet air velocity and pressure were constant at 10 m/s and 600 kPa, respectively. Steam flow rates were varied from 24 percent to 52 percent of the air flow rate. The resulting steam air mixture temperatures varied from 630 to 740 K. Combustion temperatures were in the range of 1200 to 1400 K. The steam had little effect on combustion efficiency or emissions. It was concluded that the steam acts as a diluent which has no adverse effect on catalytic combustion performance for no. 2 diesel and coal derived liquid fuels. Tests with the residual fuel showed that upstream burning could be eliminated with steam injection rates greater than 30 percent of the air flow rate, but inlet mixture temperatures were too low to permit stable catalytic combustion of this fuel. S.L.

N83-15806*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE PHOTOVOLTAIC RESEARCH AND TECHNOLOGY 1982: HIGH EFFICIENCY, RADIATION DAMAGE, AND BLANKET TECHNOLOGY
Washington 1982 263 p refs Conf. held in Cleveland, 20-22 Apr. 1982
(NASA-CP-2256; E-1303; NAS 1.55:2256) Avail: NTIS HC A12/MF A01 CSCL 10A

Space solar cell reseach and development issues are addressed. For individual titles, see N83-15807 through N83-15838.

N83-15807*# National Aeronautics and Space Administration, Washington, D. C.
NASA-OAST PROGRAM IN PHOTOVOLTAIC ENERGY CONVERSION
Jerome P. Mullin and Dennis J. Flood *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 1-4 (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

The NASA program in photovoltaic energy conversion includes research and technology development efforts on solar cells, blankets, and arrays. The overall objectives are to increase conversion efficiency, reduce mass, reduce cost, and increase operating life. The potential growth of space power requirements in the future presents a major challenge to the current state of technology in space photovoltaic systems. Author

N83-15808*# Pennsylvania Univ., Philadelphia.
NEW SILICON CELL DESIGN CONCEPTS FOR >20 PERCENT

AMI EFFICIENCY
M. Wolf *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 5-12 refs (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

The basic design principles for obtaining high efficiency in silicon solar cells are reviewed. They critically involve very long minority carrier lifetimes, not so much to attain high collection efficiency, but primarily for increased output voltages. Minority carrier lifetime, however, is sensitive to radiation damage, and particularly in low resistivity silicon, on which the high efficiency design is based. Radiation resistant space cells will therefore have to follow differing design principles than high efficiency terrestrial cells. Author

N83-15809*# Applied Solar Energy Corp., City of Industry, Calif.
RECENT DEVELOPMENTS IN THIN SILICON SOLAR CELLS
F. Ho and P. Iles *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 17-24 (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

Fifty micron thick cells 2x4 sq cm area with coplanar back contacts were made with good yield, and with output equivalent to conventional top/bottom contact cells of the same thickness. A wraparound junction (WAJ) design was selected, and used successfully. The low alpha cells delivered were all above 12%, the average efficiency was 13% and the best was 14%. The overall yield was 35 to 40%, comparable to that for conventional 50 micron cells. The process sequence was moderately complex, but showed good reproducibility. The CBC cells performed wall under several important environmental tests. High alpha CBC cells were made, with about 1% increase in conversion efficiency. The most important design criteria were the choice of back surface N+ and P+ areas. Author

N83-15810*# Spire Corp., Bedford, Mass.
LARGE AREA SPACE SOLAR CELL ASSEMBLIES
M. B. Spitzer and M. J. Nowlan *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 25-36 refs (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

Development of a large area space solar cell assembly is presented. The assembly consists of an ion implanted silicon cell and glass cover. The important attributes of fabrication are (1) use of a back surface field which is compatible with a back surface reflector, and (2) integration of coverglass application and call fabrication. Author

N83-15811*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SIMULATED SPACE FLIGHT TESTING OF COMMERCIAL TERRESTRIAL SILICON CELLS
Paul M. Stella and Tetsuo F. Miyahira *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 37-43 refs (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

Low cost silicon solar cells manufactured for the terrestrial market are examined for possible space flight use. The results of preliminary space environmental testing are reported and discussed. In addition, a number of possible obstacles to the use of these cells is examined. It is concluded that the terrestrial industry could provide an extremely low cost and reliable cell for space use. Author

N83-15812*# Nebraska Univ., Lincoln. Dept. of Electrical Engineering.
DIFFUSION LENGTH MEASUREMENTS IN SOLAR CELLS: AN ANALYSIS AND COMPARISON OF TECHNIQUES
John A. Woollam (Universal Energy Systems), A. Azim Khan, R. J. Soukup, and Allen M. Hermann (Midwest Research Inst.) *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 45-56 refs (For primary document see N83-15806 06-44)
(Grant NAG3-120)
Avail: NTIS HC A12/MF A01 CSCL 10A

A brief review of the major techniques for measuring minority carrier diffusion lengths in solar cells is given. Emphasis is placed on comparing limits of applicability for each method, especially as applied to silicon cells or to gallium arsenide cells, including the effects of radiation damage. Author

N83-15813*# Varian Associates, Palo Alto, Calif.
PROGRESS TOWARD CASCADE CELLS MADE BY OM-VPE
Peter G. Borden, Ross A. LaRue, and Michael J. Ludowise *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 57-65 refs Sponsored in part by DOE (For primary document see N83-15806 06-44)
(Contract NAS3-22232)
Avail: NTIS HC A12/MF A01 CSCL 10A

Organometallic Vapor Phase Epitaxy (COM-VPE) was used to make a sophisticated monolithic cascade cell, with a peak AMO efficiency of 16.6%, not corrected for 14% grid coverage. The cell has 9 epitaxial layers. The top cell is 1.35 microns thick with a 0.1 micron thich emitter. Both cells are heteroface n-p structures. The cascade cell uses metal interconnects. Details of growth and processing are described. Author

N83-15814*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DETERMINATION OF OPTIMUM SUNLIGHT CONCENTRATION LEVEL IN SPACE FOR 3-5 CASCADE SOLAR CELLS
Henry B. Curtis *In its* Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 69-78 refs Previously announced as 82N-32853 (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

The optimum range of concentration levels in space for III-V cascade cells was calculated using a realistic solar cell diode equation. Temperature was varied with concentration using several models and ranged from 55 C at 1 sun to between 80 and 200 C at 100 suns. A variety of series resistance and internal resistances were used. Coefficients of the diffusion and recombination terms are strongly temperature dependent. The study indicates that the maximum efficiency of 30 percent occurs in the 50 to 100 sun concentration range provided series resistance is below 0.015 ohm-sq cm and cell temperature is about 80 C at 100 suns. Author

N83-15815*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR ENERGY CONVERSION USING SURFACE PLASMONS FOR BROADBAND ENERGY TRANSPORT
Lynn Marie Anderson *In its* Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 79-87 refs (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

A new strategy for efficient solar energy conversion based on parallel processing with surface plasmons is introduced. The approach is unique in identifying: (1) a broadband carrier with suitable range for energy transport, and (2) a technique to extract more energy from the more energetic photons, without sequential losses or unique materials for each frequency band. The aim is to overcome the fundamental losses associated with the broad solar spectrum and to achieve a higher level of spectrum splitting than has been possible in semiconductor systems. Author

N83-15816*# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
AIR FORCE DEVELOPMENT OF THIN GaAs SOLAR CELLS
Ken Masloski *In* NASA. Lewis Research Center Space Photovol-

taic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 93-97 refs (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

The advantages of gallium arsenide (GaAs) over silicon (Si) type solar cells are well documented. However, two major disadvantages are weight and cost. Several ideas have recently surfaced that, if successful, will diminish these disadvantages. The CLEFT peeled film technique and the galicon cell are two of the more promising approaches. Low weight, low cost, high efficiency GaAs solar cell research is summarized. Author

N83-15817*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROGRESS TOWARD THIN-FILM GaAs SOLAR CELLS USING A SINGLE-CRYSTAL Si SUBSTRATE WITH A Ge INTERLAYER
Y. C. M. Yeh, K. L. Wang, and S. Zwerdling *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 99-104 (For primary document see N83-15806 06-44)
(Contract NAS7-100)
Avail: NTIS HC A12/MF A01 CSCL 10A

Development of a technology for fabricating light-weight, high-efficiency, radiation-resistant solar cells for space applications is reported. The approaches currently adopted are to fabricate shallow homojunction n(+)/p as well as p/n AlGaAs-heteroface GaAs solar cells by organometallic chemical vapor deposition (OM-CVD) on single-crystal Si substrates using in each case, a thin Ge epi-interlayer first grown by CVD. This approach maintains the advantages of the low specific gravity of Si as well as the high efficiency and radiation-resistant properties of the GaAs solar cell which can lead to greatly improved specific power for a solar array. The growth of single-crystal GaAs epilayers on Ge epi-interlayers on Si substrates is investigated. Related solar cell fabrication is reviewed. Author

N83-15818*# Rensselaer Polytechnic Inst., Troy, N. Y.
DIFFUSED P+-N SOLAR CELLS IN BULK GaAs
J. M. Borrego and S. K. Ghandhi *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 105-108 refs (For primary document see N83-15806 06-44)
(Grant NAG3-188)
Avail: NTIS HC A12/MF A01 CSCL 10A

Recently melt grown GaAs, made by liquid encapsulation techniques, has become available. This material is of sufficiently good quality to allow the fabrication of solar cells by direct diffusion. Results obtained with p(+)/n junction solar cells made by zinc diffusion are described. The quality of bulk GaAs for this application is evaluated. Author

N83-15819*# Rockwell International Corp., Thousand Oaks, Calif. Microelectronics Research and Development Center.
ADVANCES IN LARGE-DIAMETER LIQUID ENCAPSULATED CZOCHRALSKI GaAs
R. T. Chen, D. E. Holmes, and C. G. Kirkpatrick *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 109-122 refs (For primary document see N83-15806 06-44)
(Contracts NAS3-22224; NAS3-22235)
Avail: NTIS HC A12/MF A01 CSCL 10A

The purity, crystalline perfection, and electrical properties of n- and p-type GaAs crystals grown by the liquid encapsulated Czochralski (LEC) technique are evaluated. The determination of the dislocation density, incidence of twinning, microstructure, background purity, mobility, and minority carrier diffusion length is included. The properties of the LEC GaAs crystals are generally comparable to, if not superior to those of small-diameter GaAs material grown by conventional bulk growth techniques. As a result, LEC GaAs is suitable for application to minority carrier devices requiring high-quality and large-area substrates. Author

N83-15820*# Hughes Research Labs., Malibu, Calif.
GaAs SOLAR CELLS FOR CONCENTRATOR SYSTEMS IN SPACE
R. Y. Loo, R. C. Knechtli, and G. S. Kamath *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1983 p 123-130 refs (For primary document see N83-15806 06-44)
(Contract NAS3-22227)
Avail: NTIS HC A12/MF A01 CSCL 10A

Cells for operation in space up to more than 100 suns were made, and an AMO efficiency of 21% at 100 suns with these cells was obtained. The increased efficiency resulted not only from the higher open circuit voltage associated with the higher light intensity (higher short circuit current); it also benefitted from the increase in fill factor caused by the lower relative contribution of the generation recombination current to the forward bias current when the cell's operating current density is increased. The experimental cells exhibited an AMO efficiency close to 16% at 200 C. The prospect of exploiting this capability for the continuous annealing of radiation damage or for high temperature missions (e.g., near Sun missions) remains therefore open. Space systems with concentration ratios on the order of 100 suns are presently under development. The tradeoff between increased concentration ratio and increased loss due to the cell's series resistance remains attractive even for space applications at a solar concentrator ratio of 100 suns. In the design of contact configuration with low enough series resistance for such solar concentration ratios, the shallow junction depth needed for good radiation hardness and the thin AlGaAs layer thickness needed to avoid excessive optical absorption losses have to be retained. Author

N83-15821*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF DIFFERENT SOLAR SIMULATORS ON THE MEASUREMENT OF SHORT-CIRCUIT CURRENT TEMPERATURE COEFFICIENTS
Henry B. Curtis and R. E. Hart, Jr. *In its* Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 131-136 refs (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

Gallium arsenide solar cells are considered for several high temperature missions in space. Both near-Sun and concentrator missions could involve cell temperatures on the order of 200 C. Performance measurements of cells at elevated temperatures are usually made using simulated sunlight and a matched reference cell. Due to the change in bandgap with increasing temperature at portions of the spectrum where considerable simulated irradiance is present, there are significant differences in measured short circuit current at elevated temperatures among different simulators. To illustrate this, both experimental and theoretical data are presented for gallium arsenide cells. Author

N83-15822*# Florida Univ., Gainesville.
DEFECTS AND ANNEALING STUDIES IN 1-Me ELECTRON IRRADIATED (AlGa)As-GaAs SOLAR CELLS
Sheng S. Li, W. L. Wang, R. Y. Loo (Hughes Research Labs.), and W. P. Rahilly (AFWAL) *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 137-144 ref Sponsored in part by AFWAL (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

The deep-level defects and recombination mechanisms in the one-MeV electron irradiated (AlGa)As-GaAs solar cells under various irradiation and annealing conditions are discussed. Deep-level transient spectroscopy (DLTS) and capacitance-voltage (CV) techniques were used to determine the defect and recombination parameters such as energy levels and defect density, carrier capture cross sections and lifetimes for both electron and hole traps as well as hole diffusion lengths in these electron irradiated GaAs solar cells. GaAs solar cells used in this study were prepared by the infinite solution melt liquid phase epitaxial (LPE) technique

at Hughes Research Lab., with (Al0.9Ga0.1)-As window layer, Be-diffused p-GaAs layer on Sn-doped n-GaAs or undoped n-GaAs active layer grown on n(+)-GaAs substrate. Mesa structure with area of 5.86x1000 sq cm was fabricated. Three different irradiation and annealing experiments were performed on these solar cells. Author

N83-15823*# Rome Air Development Center, Hanscom AFB, Mass.

DEFECT BEHAVIOR IN ELECTRON-IRRADIATED BORON- AND GALLIUM-DOPED SILICON

Peter J. Drevinsky and Henry M. DeAngelis *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol 1982 p 145-155 refs (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

Production and anneal of defects in electron-irradiated, float-zone silicon solar cells were studied by DLTS. In boron- and gallium-doped, n+-p cells, dominant defects were due to the divacancy, carbon interstitial, and carbon complex. Results suggest that the DLTS peak normally ascribed to carbon complexes also involves gallium. For gallium- and, to a lesser extent, boron-doped samples, damaged lifetime shows substantial recovery only when the carbon-complex peak has annealed out at 400 C. In boron-doped, n+-p-p+ cells, a minority carrier trap (E1) was also observed by DLTS in cells with a boron p+, but not in those with an aluminum p+ back. A level at Ev + 0.31 eV appeared upon 150 C annealing (E1 out) in both p+ back types of samples. Author

N83-15824*# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

COLD CRUCIBLE CZOCHRALSKI FOR SOLAR CELLS

Terry M. Trumble *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 157-161 refs (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

The efficiency and radiation resistance of present silicon solar cells are a function of the oxygen and carbon impurities and the boron doping used to provide the proper resistivity material. The standard Czochralski process used grow single crystal silicon contaminates the silicon stock material due to the use of a quartz crucible and graphite components. The use of a process which replaces these elements with a water cooled copper to crucible has provided a major step in providing gallium doped (100) crystal orientation, low oxygen, low carbon, silicon. A discussion of the Cold Crucible Czochralski process and recent float Zone developments is provided. L.F.M.

N83-15825*# Lincoln Lab., Mass. Inst. of Tech., Lexington.

MICRODISTRIBUTION OF OXYGEN IN SILICON AND ITS EFFECTS ON ELECTRONIC PROPERTIES

H. C. Gatos, B.-Y. Mao, K. Nauka, and J. Lagowski *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 163-169 refs (For primary document see N83-15806 06-44)
(Grant NsG-3017)
Avail: NTIS HC A12/MF A01 CSCL 10A

The effects of interstitial oxygen on the electrical characteristics of Czochralski-grown silicon crystals were investigated for the first time on a microscale. It was found that the generation of thermal donors is not a direct function of the oxygen concentration. It was further found that the minority carrier life-time decreases with increasing oxygen concentration, on a microscale in as-grown crystals. It was thus shown, again for the first time, that oxygen in as grown crystals is not electronically inert as generally believed. Preannealing at 1200 C commonly employed in device fabrication, was found to suppress the donor generation at 450 C and to decrease the deep level concentrations. Author

N83-15826*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RADIATION DAMAGE AND ANNEALING IN LARGE AREA n+/p/p+ GaAs SHALLOW HOMOJUNCTION SOLAR CELLS

D. J. Flood, D. J. Brinker, C. K. Swartz, R. E. Hart, Jr., and John C. C. Fan (MIT, Lincoln Lab., Lexington) *In its* Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 179-184 refs (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

Annealing of radiation damage was observed for the first time in VPE-grown, 2- by 2-cm, n+/p/p+ GaAs shallow homojunction solar cells. Electrical performance of several cells was determined as a function of 1-MeV electron fluence in the range of 10 to the 13th power to 10 to the 15th power e-/sq cm and as a function of thermal annealing time at various temperatures. Degradation of normalized power output after a fluence of 10 to the 15th power 1-MeV electrons/sq cm ranged from a low of 24 to 31 percent of initial maximum power. Normalized short circuit current degradation was limited to the range from 10 to 19 percent of preirradiated values. Thermal annealing was carried out in a flowing nitrogen gas ambient, with annealing temperatures spanning the range from 125 to 200 C. Substantial recovery of short circuit current was observed at temperatures as low as 175 C. In one case improvement by as much as 10 percent of the postirradiated value was observed. The key features of these cells are their extremely thin emitter layers (approxmately 0.05 micrometers), the absence of any Al sub xGd sub 1-x As passivating window layer, and their fabrication by vapor phase epitaxy. Author

N83-15827*# Communications Satellite Corp., Clarksburg, Md.

BASIS FOR EQUIVALENT FLUENCE CONCEPT IN SPACE SOLAR CELLS

A. Meulenberg *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 185-194 refs (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

The equivalent fluence concept is defined, and its use and potential problems are noted. Silicon and GaAs solar cells are compared in a radiation environment. The analysis indicates that valid equivalent fluence values may be easier to obtain in GaAs than in silicon. Author

N83-15828*# Florida Univ., Gainesville.

GROWN-IN DEFECTS AND DEFECTS PRODUCED BY 1-Me ELECTRON IRRADIATED IN Al0.3Ga0.7As P-N JUNCTION SOLAR CELLS

Sheng S. Li, K. W. Teng, D. W. Schoenfeld, and W. P. Rahilly (AFWAL) *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 195-200 refs Sponsored in part by AFWAL (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

Studies of grown-in defects and defects produced by the one-MeV electron irradiation in Al sub 0.3 Ga sub 0.7As p-n junction solar cells fabricated by liquid phase epitaxial (LPE) technique were made for the unirradiated and one-MeV electron irradiated samples, using DLTS and C-V methods. Defect and recombination parameters such as energy level, defect density, carrier capture cross sections and lifetimes were determined for various growth, annealing, and irradiation conditions. L.F.M.

N83-15829*# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

PROGRESS IN DEVELOPING HIGH PERFORMANCE SOLAR BLANKETS AND ARRAYS

John Scott-Monck *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 201-209 refs (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

The development of high efficiency, ultrathin silicon solar cells

offers both opportunity and challenge. It is possible to consider 400 W/kg blanket designs by using this cell in conjuction with flexible substrates, ultrathin covers and welded interconnects. By designing array structure which is mechanically and dynamically compatible with very low mass blankets, solar arrays with a specific power approaching 200 W/kg are achievable. Further improvements in blanket performance (higher power and lower mass per unit area), which could come from the implementation of higher efficiency cells operating at lower temperatures (silicon or GaAs), and the use of encapsulants, would result in the development of 300 W/kg solar arrays. L.F.M.

N83-15830*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

MINIATURIZED CASSEGRAINIAN CONCENTRATOR CONCEPT DEMONSTRATION

R. E. Patterson and H. S. Rauschenbach *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 211-221 refs (For primary document see N83-15806 06-44) (Contract NAS8-34131)

Avail: NTIS HC A12/MF A01 CSCL 10A

High concentration ratio photovoltaic systems for space applications have generally been considered impractical because of perceived difficulties in controlling solar cell temperatures to reasonably low values. A miniaturized concentrator system is now under development which surmounts this objection by providing acceptable solar cell temperatures using purely passive cell cooling methods. An array of identical miniaturized, rigid Cassegrainian optical systems having a low f-number with resulting short dimensions along their optical axes are rigidly mounted into a frame to form a relatively thin concentrator solar array panel. A number of such panels, approximately 1.5 centimeters thick, are wired as an array and are folded against one another for launch in a stowed configuration. Deployment on orbit is similar to the deployment of conventional planar honeycomb panel arrays or flexible blanket arrays. The miniaturized concept was conceived and studied in the 1978-80 time frame. Progress in the feasibility demonstration to date is reported. L.F.M.

N83-15831*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

THE COURSE OF SOLAR ARRAY WELDING TECHNOLOGY DEVELOPMENT

Paul M. Stella *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 223-230 refs (For primary document see N83-15806 06-44)

Avail: NTIS HC A12/MF A01 CSCL 10A

Solar array welding technology is examined from its beginnings in the late 1960's to the present. The U.S. and European efforts are compared, and significant similarities are highlighted. The utilization of welding technology for space use is shown to have been influenced by a number of subtle, secondary factors. Author

N83-15832*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

A PRELIMINARY EVALUATION OF A POTENTIAL SPACE WORTH ENCAPSULANT

John Scott-Monck *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 231-236 refs (For primary document see N83-15806 06-44)

Avail: NTIS HC A12/MF A01 CSCL 10A

A new polymer polyimide possessing optical and mechanical properties potentially suitable for space applications now exists. A preliminary evaluation of the material indicates that in its present state of development, the polyimide is not ready for space qualification. Further efforts to increase molecular weight and purify the consituents used to synthesize it are warranted. Activities addressing these needs are now being pursued. If these approaches prove successful, additional testing will take place with an emphasis on synergistic effects. L.F.M.

N83-15833*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MICROSTRUCTURAL ANALYSIS OF SOLAR CELL WELDS

T. J. Moore, G. K. Watson, and C. R. Baraona *In its* Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 237-249 refs (For primary document see N83-15806 06-44)

Avail: NTIS HC A12/MF A01 CSCL 10A

Parallel-gap resistance welding of silicon solar cells with copper interconnects results in complex microstructural variations that depend on the welding variables. At relatively low heat input solid-state welds are produced. At medium heat the Ag-Cu eutectic forms resulting in a braze joint. High heat produces a fusion weld with complete melting of the silver layer on the silicon solar cell. If the silicon is also melted, cracking occurs in the silicon cell below the weld nugget. These determinations were made using light microscopy, microprobe, and scanning electron microscopy analyses. Author

N83-15834*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EVALUATION OF SOLAR CELL WELDS BY SCANNING ACOUSTIC MICROSCOPY

S. J. Klima, W. E. Frey, and C. R. Baraona *In its* Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 251-258 refs (For primary document see N83-15806 06-44)

Avail: NTIS HC A12/MF A01 CSCL 10A

Scanning laser acoustic microscopy was used to nondestructively evaluate solar cell interconnect bonds made by resistance welding. Both copper-silver and silver-silver welds were analyzed. The bonds were produced either by a conventional parallel-gap welding technique using rectangular electrodes or new annular gap design with a circular electrode cross section. With the scanning laser acoustic microscope, it was possible to produce a real time television image which reveales the weld configuration as it relates to electrode geometry. The effect of electrode misalinement with the surface of the cell was also determined. A preliminary metallographic analysis was performed on selected welds to establish the relationship between actual size and shape of the weld area and the information available from acoustic micrographs. Author

N83-15835*# Communications Satellite Corp., Clarksburg, Md.

SILICON RESEARCH AND TECHNOLOGY

A. Meulenberg *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 259-263 (For primary document see N83-15806 06-44)

Avail: NTIS HC A12/MF A01 CSCL 10A

The development of solar cells suitable for space applications are discussed, along with the advantages and disadvantages of silicon and gallium arsenide solar cells. The goal of a silicon solar cell with 18% efficiency has not been reached and does not appear promising in the near future. L.F.M.

N83-15836*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

GaAs SOLAR CELLS

E. J. Conway *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 265-266 (For primary document see N83-15806 06-44)

Avail: NTIS HC A12/MF A01 CSCL 10A

The major thrusts proposed for GaAs were increased efficiency and improved radiation damage data. Current laboratory production cells consistently achieve 16 percent AMO one-Sun efficiency. The user community wants 18-percent efficient cells as soon as possible, and such a goal is though to be achievable in 2 years with sufficient research funds. A 20-percent research cell is considered the efficiency limit with current technology, and such a cell seems realizable in approximately 4 years. Future efficiency improvements await improved substrates and materials. For still

higher efficiencies, concentrator cells and multijunction cells are proposed as near-term directions. L.F.M.

N83-15837*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIATION DAMAGE
I. Weinberg *In its* Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 267-268 (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

The radiation damage workshop considered a variety of topics among which were the need for equivalent electron fluences in gallium arsenide, the possibility of 15 percent end-of-life efficiencies for silicon, increasing radiation resistance in gallium arsenide, annealing of radiation damage and the need for radiation damage studies in cascade cells. The workshop members agreed that a high priority should be assigned to obtaining equivalent electron fluences for gallium arsenide cells. It was suggested that 1 MeV would be a reasonable electron energy for this purpose. Special care should be given to proton irradiations particularly for energies below 1 MeV. In addition, omnidirectional rather than normal incidence protons should be used. It was also agreed that there was a need for obtaining damage coefficients in gallium arsenide. In silicon, there is a requirement for additional flight data, especially in proton dominated orbits. These data are needed to further check the accuracy of the 1 MeV equivalence fluences. L.F.M.

N83-15838*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
BLANKET TECHNOLOGY
John Scott-Monck *In* NASA. Lewis Research Center Space Photovoltaic Res. and Technol. 1982: High Efficiency, Radiation Damage, and Blanket Technol. 1982 p 269-272 (For primary document see N83-15806 06-44)
Avail: NTIS HC A12/MF A01 CSCL 10A

It was concluded that systems requirements would force a reassessment of the conventional approach to interconnecting cells into blanket or array modules. Defense applications (hardening) were identified as the key requirement that would force a movement away from the standard method (solder) of forming array circuits. The panel also agreed that requirements associated with the impending NASA Space Station and in-bound missions would lead to alternative interconnecting approaches. It was concluded that the diverse requirements of future space missions (high temperature and extended thermal cycling) might not be met by one approach, such as parallel-gap resistance welding. The panel suggested that other options such as high temperature solders and brazing be considered for the various mission requirements that were anticipated. The panel agreed that blanket technology was potentially suitable for in-orbit annealing to temperatures of 200 C provided that conventional soldered connecting techniques were replaced by 'welding'. L.F.M.

N83-15839*# Engelhard Industries, Inc., Edison, N.J.
DEVELOP AND TEST FUEL CELL POWERED ON-SITE INTEGRATED TOTAL ENERGY SYSTEM Quarterly Report
A. Kaufman and G. K. Johnson 3 Nov. 1982 47 p
(Contracts DEN3-241; DE-AI01-80ET-17088)
(NASA-CR-168020; NAS 1.26:168020; QR-5) Avail: NTIS HC A03/MF A01 CSCL 10A

Satisfactory performance is reported for the first 12-cell sub-stack of the 5 kW rebuild using improved ABA reactant distribution plates. Construction and test results are described for the first full-sized single-cell test (0.33 m x 0.56 m). Test duration was 450 hours. Plans are outlined for construction and testing of two methanol reformer units based on commercially-available shell-and-tube heat exchangers. A 5 kW-equivalent precursor and a 50 kW-equivalent prototype will be built. Supporting design and single-tube experimental data are presented. Stack support efforts are summarized on corrosion currents of graphite materials and acid-management of single-cell test facilities. Comparative properties are summarized for the two methanol/steam reforming catalysts evauated under Task V (now completed); T2107RS and C70-2RS. Author

N83-15840*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE WORLDWIDE MARKET FOR PHOTOVOLTAICS IN THE RURAL SECTOR
William A. Brainard 1982 15 p refs Presented at 16th Photovoltaic Specialists Conf., San Diego, Calif., 27-30 Sep. 1982; sponsored by IEEE
(Contract DE-AI01-79ET-20485)
(NASA-TM-83035; E-1473; DOE/NASA/20485-13; NAS 1.15:83035) Avail: NTIS HC A02/MF A01 CSCL 10A

The worldwide market for stand-alone photovoltaic power systems in three specific segments of the rural sector were determined. The worldwide market for photovoltaic power systems for village power, cottage industry, and agricultural applications were addressed. The objectives of these studies were to: The market potential for small stand-alone photovoltaic power system in specific application areas was assessed. Technical, social and institutional barriers to PV utilization were identified. Funding sources available to potential users was also identified and marketing strategies appropriate for each sector were recommended to PV product manufacturers. The studies were prepared on the basis of data gathered from domestic sources and from field trips to representative countries. Both country-specific and sector-specific results are discussed, and broadly applicable barriers pertinent to international marketing of PV products are presented. S.L.

N83-15841# R and D Associates, Rosslyn, Va.
PROCEEDINGS OF THE AFOSR SPECIAL CONFERENCE ON PRIME-POWER FOR HIGH ENERGY SPACE SYSTEMS, VOLUME 1 Final Report
P. J. Turchi 1982 767 p refs Conf. held in Norfolk, Va., 22-25 Feb. 1982 2 Vol.
(Contract F49620-82-C-0008)
(AD-A118887; AFOSR-82-0655TR-Vol-1) Avail: NTIS HC A99/MF A01 CSCL 10/2

State-of-the-art space prime-power technology is reviewed. Research needs for progress toward megawatt power levels are discussed. Chemical, nuclear, and radiant energy techniques, power conversion, heat rejection, materials, chemical and fluid physics are discussed. For individual titles, see N83-15842 through N83-15859.

N83-15842# Boeing Aerospace Co., Seattle, Wash.
POWER REQUIREMENTS FOR MANNED SPACE STATIONS
Gordon R. Woodcock and Sidney Silverman *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 20 p (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/2

The power requirements, the tradeoff between batteries and regenerative fuel cells, including how the electric power system can be integrated with other functions, and nuclear concepts are summarized. The influence of mission applications on selection of the power system is discussed, including low Earth orbit and high Earth orbit civil missions and potential military missions. Author

N83-15843# Air Force Office of Scientific Research, Bolling AFB, Washington, D.C. Aerospace Sciences Directorate.
POWER REQUIREMENTS FOR ORBIT RAISING PROPULSION c20
Leonard H. Caveny *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 15 p refs (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 21/8

Propulsion systems are considered in two categories: conventional (chemical) and nonconventional (e.g., beamed energy and electric). Several types of propulsion concepts are compared on a propulsive efficiency (exhaust velocity) and thrust density plot. The magneto-plasma-dynamic thruster is discussed. Beamed

energy propulsion is considered. Thermal management is summarized, and power for electric thrusters is reviewed. Author

N83-15844# Eagle-Picher Industries, Inc., Joplin, Mo. Electronics Div.
CHEMICAL SOURCES: BATTERY
Robert A. Brown *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 12 p (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/3

The particular aspects of space power requirements that are critical to batteries are discussed. Power density and energy density values for various electrochemical systems and battery configurations are shown as a function of the time duration of the power pulse. Characteristics of the possible battery systems are listed in order to match specific battery systems to individual power requirements. A general discussion is presented regarding the advantages batteries offer over other types of power sources. Author

N83-15845# United Technologies Corp., East Hartford, Conn.
ALKALINE FUEL CELLS FOR PRIME POWER AND ENERGY STORAGE
J. K. Stedman *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 42 p (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/1

Alkaline fuel cell technology and its application to future space missions requiring high power and energy storage are discussed. Energy densities exceeding 100 watthours per pound and power densities approaching 0.5 pounds per kilowatt are calculated for advanced systems. Materials research to allow reversible operation of cells for energy storage and higher temperature operation for peaking power is warranted. Author

N83-15846# R and D Associates, Rosslyn, Va.
MHD POWER: OVERVIEW
J. B. Dicks (Applied Energetics, Inc.) *In its* Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 17 p (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/2

MHD is one of those technologies which has reached an engineering status that would allow it to be applied where the need for short time high powered systems arise. It has the advantage of almost immediate full power production from a inert start, is thus capable of high reliability, but is limited in time to that available utilizing uncooled heat sink configurations. Such a time at present is of the order of 100-150 seconds with extended lifetime depending on the amount of cooling are placed in the system. All of this technology is based on an engineering understanding of the device, but comparatively little physical understanding. The phenomenon involved are complex, involving a combination of Maxwell's equations with the gasdynamic equations. Furthermore, the phenomena of the boundary layer between the hot plasma and the cold electrodes are in a even more difficult regime of temperature over shoots, recombination, surface interaction, and prevalent surface phenomena. Author

N83-15847*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA LEWIS RESEARCH CENTER COMBUSTION MHD EXPERIMENT
John M. Smith *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 10 p refs (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/2

The MHD power generation experiments were conducted in a high field strength cryomagnet which was adapted from an existing facility. In its original construction, it consisted of 12 high purity aluminum coils pool cooled in a bath of liquid neon. In this configuration, a peak field of 15 tesla was produced. For the present experiments, the center four coils were removed and a 23 cm diameter transverse warm bore tube was inserted to allow the placement of the MHD experiment between the remaining eight coils. In this configuration, a peak field of $>$ 6 tesla should be obtainable. The time duration of the experiment is limited by the neon supply which allows on the order of 1 minute of total operating time followed by an 18-hour reliquefaction period. As a result, the experiments are run in a pulsed mode. The run duration for the data presented here was 5 sec. The magnetic field profile along the MHD duct is shown. Since the working fluid is in essence superheated steam, it is easily water quenched at the exit of the diffuser and the components are designed vacuum tight so that the exhaust pipe and demister an be pumped down to simulate the vacuum of outer space. Author

N83-15848# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
THE MHD DISK GENERATOR AS A MULTIMEGAWATT POWER SUPPLY OPERATING WITH CHEMICAL AND NUCLEAR SOURCES
J. F. Louis *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 17 p (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/2

The characteristics, performance and status of the MHD disk generator are reviewed as a potential multimegawatt power supply working with both chemical and nuclear sources. The disk generator is found to be a compact high interaction power unit with simple construction simple power conditioning and using a circular superconducting coil. The radial flow of the disk assures zero thrust in open loop operation and its construction simplicity may provide significant reliability and weight advantages. The disk generator can be operated as a high voltage, low current power supply. Experiments have shown the disk generator as high power (900 kW), high power density (500 MW/cu cm), high enthalpy extraction (15%) device which has been operated with electrical fields up to 37 kV/m. The disk generator can be operated in an open loop with either chemical or nuclear heat sources. In a closed cycle system, the disk generator can be used in a Braylon cycle using He working fluid and in a Rankin cycle using either potassium or lithium vapors as working fluid. In both cases, the generator operates in the non-equilibrium mode. Author

N83-15849# STD Research Corp., Arcadia, Calif.
SELF-EXCITED MHD POWER SOURCE FOR SPACE APPLICATIONS
C. D. Maxwell, C. D. Bangerter, and S. T. Demetriades *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy space Systems, Vol. 1 1982 11 p (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/2

Small, self-excited, combustion-driven MHD systems with mass-to-power ratios of the order 1 kg/kW and specific energy extraction rates of 0.8 MJ/kg of fuel were tested. Small, self-excited, chemical explosion-driven giant-pulse generators with mass-to-power ratios of the order 0.001 kg/kW and specific energy extraction rates of 0.4 MG/kg of explosive were tested. The experimental, results to date with CW-MHD and Pulsed MHD devices are extrapolated to the expected performance in the space environment. The fluid mechanics of high-interaction, moderate-to-high magnetic Reynolds number MHD flows govern (and will ultimately limit) the performance of such devices. These fundamental limitations must be properly understood before devices of these or better specifications can be constructed. Author

N83-15850# Argonne National Lab., Ill.
LIQUID-METAL MHD FOR SPACE POWER SYSTEMS
E. S. Pierson *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 14 p refs (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/2

The two-phase-generator liquid-metal MHD (LMMHD) energy-conversion concept, developed at Argonne National Laboratory, appears very attractive for space applications. It combines the high-temperaure capability and high power density of the previous-

proposed LMMHD concepts with a high cycle efficiency unattainable with these previous LMMHD concepts. The operation of the Brayton-cycle (gas-cycle) and Rankine-cycle (vapor-cycle) two-phase-generator LMMHD concepts is explained. The key features which make LMMHD attractive for space applications are summarized. The current status of LMMHD technology is discussed, with emphasis on the experimental data. ANL has the technology base to analyze LMMHD systems for space power applications, and to build prototypes at different temperatures. Author

N83-15851# AMAF Industries, Columbia, Md.
SOLAR MHD SYSTEMS WITH TWO-PHASE FLOW WITH MAGNETIC LIQUID METAL
Amit Goswami, Ronald D. Graves, and Carl Spight *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 7 p refs (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/1

Solar power is one of the major resources available to space systems. Whereas the technology of solar cells and its limitations are well known, there is another technique, solar LMMHD, pioneered by H. Branover and E. Pierson which shows promise as a relatively high efficiency, inexpensive and compact prime power device usable in space. The solar LMMHD system employs a liquid metal to extract heat from a mirror-solar collector system. A second organic volatile liquid is then allowed to come in contact with the hot metal and evaporate. The two phase fluid system then moves along a pipe, the gas imparting part of its flow momentum to the liquid metal. The moving liquid metal passes through a magnetic field perpendicular to the flow direction; thereby an induced current is generated which is collected by the usual electrode ensemble. Author

N83-15852# Avco-Everett Research Lab., Mass.
MAGNETOHYDRODYNAMIC POWER SUPPLY SYSTEMS FOR SPACE APPLICATIONS
Daniel W. Swallom *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 34 p (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/2

The MHD power supply system can provide tens of megawatts of electrical power for space applications. The system has substantially operating flexibility for various operating times, pulse lengths and pulse rates, and power levels. The instant on/instant off capability provides the necessary response to command signals. The overall power system is a high efficiency, low mass and volume device which is attractive for space applications. Author

N83-15853# SeiTec, Cleveland, Ohio.
POTENTIAL ROLE AND TECHNOLOGY STATUS OF CLOSED-CYCLE MHD FOR LIGHT-WEIGHT NUCLEAR SPACE-POWER SYSTEMS
George R. Seikel and Bert Zauderer *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy space Systems, Vol. 1 1982 15 p refs (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/2

If power is required in space for more than a large fraction of a day, steady state power sources (such as solar and nuclear) will have the lightest system weight. If megawatts of power are needed, closed cycle MHD systems (if successfully developed) have the potential of being very light and highly efficient. Such MHD generators are uniquely capable of fully exploiting advances in high-temperature reactor technology which could make up to 2500 K long-life, iner-gas-cooled reactors feasible. A particularly attractive MHD system is a turbo-MHD cycle which has a turbine driven compressor. It potentially have very low specific mass, high efficiency, and relatively low MHD generator enthalpy extraction. Author

N83-15854# Stanford Univ., Calif.
MHD GENERATOR RESEARCH AT STANFORD
J. K. Koester, C. H. Kruger, and T. Nakamura *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 22 p refs (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/2

The behavior of MHD channels has been studied over a wide range of conditions in the High Temperature Gasdynamics Laboratory at Stanford University. This research is primarily experimental in nature with the use of advanced diagnostic methods and comparable theoretical and numerical studies for the interpretation of the data and application of the results to large-scale generators. Present MHD research areas include MHD boundary layer interactions, Hall-field breakdown, plasma nonuniformities, plasma fluctuations and magneto-acoustic waves, surface deposits of slag, disk generators, and electrode configurations. Plasma velocity, temperature, and electron number density have been measured with spatial and temporal resolution by optical diagnostics. Many channel phenomena such as electrode boundary layer Joule heating, sidewall boundary layer velocity overshoot, slag particle size, effect of radicals on electron density, and surface deposit polarization have been observed, measured, and compared with theory. These results are intended to provide support for MHD hardware development in areas where performance limitations and design constraints are not now adequately understood. Author

N83-15855# Los Alamos Scientific Lab., N. Mex.
OVERVIEW OF SPACE REACTORS
David Buden *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 44 p (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/2

An overview of spacecraft power supplies needed in the future is presented in outline form. Subjects portrayed and discussed are: potential space power missions, space power technology capabilities, conversion technology, radiator technology, and reactor safety. L.F.M.

N83-15856# Oak Ridge National Lab., Tenn.
TECHNOLOGICAL BOUNDARY CONDITIONS FOR NUCLEAR ELECTRIC SPACE POWER PLANTS
A. P. Fraas *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 20 p refs (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/2

A serious attempt to assess the potential and feasibility of the many candidates for nuclear electric space power applications must confront some basic technological facts that limit what one can reasonably hope to accomplish with ay given concept. First, the upper limit to the efficiency of any thermodynamic cycle was defined by Carnot, and the subsequent 160 years has not only disclosed the character and magnitude of the many losses that regretably but inevitably make the efficiency of any actual cycle much less than that of an ideal cycle, but has also shown the upper temperature limit attainable with the materials available for any actual cycle. The cycle efficiency determines not only the thermal energy output of the reactor required for any given electrical power output (and thus the size and weight of the reactor and shield assembly), but also the size and weight of the radiator to reject the waste heat. Materials considerations such as corrosion, strength, and radiation damage at elevated temperatures establish basic limits on the design of the reactor, shield, turbine, generator, and other key components. Allowable radiation doses to personnel, lubricants, elastomers, and electronic components determine the size, weight, and shape of the reactor shield after account is taken of such factors as activation of the reactor coolant, directional differences in the degree of shielding required for the spacecraft in question, and radiation scattering from structures such as the radiator. Further, an exceptionally high reliability with essentially no maintenance is required. Author

N83-15857# Rasor Associates, Inc., Sunnyvale, Calif.
EFFECTS OF REACTOR DESIGN, COMPONENT CHARACTERISTICS AND OPERATING TEMPERATURES ON DIRECT CONVERSION POWER SYSTEMS

G. O. Fitzpatrick and E. J. Britt *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 24 p refs (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/2

The results of a parametric study of unmanned space nuclear reactor power systems utilizing either thermoelectric or thermionic energy converters are presented. An in-core reactor design and two heat pipe cooled out-of-core reactor designs were considered. One of the out-of-core designs utilized long heat pipes directly coupled to the energy converters. The second utilized a larger number of smaller heat pipes (mini-pipe) radiatively coupled to the energy converter. In all cases the entire system, including the power conditioning subsystem and its radiator, were constrained to be launched by a single shuttle. The mass and size of each system was studied as a function of several variables including: power level, lifetime, number and size of core heat pipes, fuel swelling model, reactor and heat rejection temperatures, converter type and performance level, allowable radiation dose at the payload, shadow shield cone angle, power conditioning temperature and efficiency, etc. The most critical component determining system performance is the reactor. Its design is driven by concerns for fuel swelling rate which is in turn dependent on the nature of the swelling, reactor power level, and the number and size of the heat pipes used to cool the core. Author

N83-15858# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
GAS COOLED REACTORS FOR LARGE SPACE POWER NEEDS
G. H. Parker *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 21 p (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/2

Gas cooled space reactors can be built in the next few years and their performance capabilities exceed those of the power conversion systems (PCS) that the reactors will drive. For space applications requiring MW(e), the closed cycle Brayton cycle is a strong candidate for the PCS. For these high power levels, waste heat rejection to space by radiators tends to drive systems to high operating temperatures so that reasonably sized system envelope dimensions can be attained. Thus, compact, high power density, high temperature, high burnup reactors will be needed. The technology base for these reactors is well established. Author

N83-15859# Brookhaven National Lab., Upton, N. Y. Dept. of Nuclear Energy.
COMPACT, HIGH-POWER NUCLEAR REACTOR SYSTEMS BASED ON SMALL DIAMETER PARTICULATE FUEL
J. R. Powell and T. E. Botts *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 1 1982 5 p (For primary document see N83-15841 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10/2

Two compact, high-power nuclear reactor concepts are discussed. Both are gas-cooled cavity-type reactors which utilize particulate fuel of the type now used in HTGR reactors. Unshielded reactor volumes are on the order of one cubic meter. The Fixed Bed Reactor operating temperature is limited to 2500 K and the output power to 250 MW(e). In the Rotating Bed Reactor fuel is held within a rotating porous metal drum as a rotating fluidized bed. Rotating Bed Reactor outlet temperatures up to 3000 K and output power levels up to 1000 MW(e) are achievable. Both reactors can be brought up from stand by to full power in times on the order of a few seconds, due primarily to the short thermal time constant for the fuel particles. Turbine and MHD Brayton are the power conversion cycles of choice. Open cycle operation is generally favored for applications operating at less than 1000 sec of equivalent integrated full power. At power levels above 1 MW(e), the liquid droplet radiator is the favored means of heat rejection. Power system specific power levels of 10 kW(e)/kg (not including shield) appears to be quite feasible. Author

N83-15860# R and D Associates, Rosslyn, Va.
PROCEEDINGS OF THE AFOSR SPECIAL CONFERENCE ON PRIME-POWER FOR HIGH ENERGY SPACE SYSTEMS, VOLUME 2 Final Report
P. J. Turchi 1982 834 p refs Conf. held in Norfolk, Va., 22-25 Feb. 1982 2 Vol.
(Contract F49620-82-C-0008)
(AD-A118888; AFOSR-82-0656TR-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 10/2

The state of the art of space prime power technology is reviewed and research needed for progress toward megawatt power levels is discussed. Radiant energy techniques, materials requirements, chemical physics, thermionics, thermal management systems, and power requirements of future NASA and DOE system are addressed. For individual titles, see N83-15861 through N83-15898.

N83-15861*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PROPOSED OPTICAL PUMPING SYSTEM REQUIRING NO ELECTRIC POWER Final Report **c74**
Bert R. Phillips *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 11 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20F

A method for optically pumping a fluid without electrical power is described. The method is based on utilizing the radiation from a metal oxidant combustion reaction that is contained within a transparent tube that is immersed in the medium to be pumped. The reaction initiation and maintenance occurs by gas dynamically induced resonance within the transparent cavity. All that is required is a supply of high pressure oxidant and metallic powder. Materials that were successfully evaluated to date include aluminum, steel, magnesium, and titanium. M.G.

N83-15862# Illinois Univ., Urbana. Fusion Studies Lab.
STATUS, RESEARCH REQUIREMENTS AND POTENTIAL APPLICATIONS FOR NUCLEAR PUMPED LASERS Final Report **c36**
George H. Miley *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 30 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10A

Mechanisms and various approaches to nuclear pumping of lasers are reviewed. Experimental results to date (including various noble gas lasers and more recent N2-He-CO2 and O2(1 delta)-I2 transfer lasers) are briefly noted. Both physics issues (e.g., electron energy distributions) and technology issues (e.g., coatings vs. UF6 neutron interaction regions) are identified. Finally, considerations involved in potentially attractive applications such as space nuclear laser systems and neutron feedback inertial confinement fusion are outlined. M.G.

N83-15863# Argonne National Lab., Ill.
PRIME POWER FOR HIGH-ENERGY SPACE SYSTEMS: CERTAIN RESEARCH ISSUES Final Report
Edward W. Walbridge *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 10 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10A

The physical mechanisms underlying Alfven wave drag and induced magnetic moment effects on high energy space systems are described. An expression for the induced magnetic moment of a (ring-shaped) satellite is presented. Several other issues requiring attention are also pointed out. These include, in particular, the need to avoid a demise like that of Skylab, how to obtain high heat engine thermal efficiency, what to do about the damaging effects of Van Allen belt radiation, and the need for storing energy over long periods but having it quickly available on short notice. M.G.

N83-15864*# Rasor Associates, Inc., Sunnyvale, Calif.
STATUS OF THERMOELECTRONIC LASER ENERGY CONVERSION, TELEC Final Report
E. J. Britt *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 11 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10B

A concept known as a thermo-electronic laser energy converter (TELEC), was studied as a method of converting a 10.6 micron CO2 laser beam into electric power. The calculated characteristics of a TELEC seem to be well matched to the requirements of a spacecraft laser energy conversion system. The TELEC is a high power density plasma device which absorbs an intense laser beam by inverse bremstrahlung with the plasma electrons. In the TELEC process, electromagnetic radiation is absorbed directly in the plasma electrons producing a high electron temperature. The energetic electrons diffuse out of the plasma striking two electrodes which are in contact with the plasma at the boundaries. These two electrodes have different areas: the larger one is designated as the collector, the smaller one is designated as the emitter. The smaller electrode functions as an electron emitter provide continuity of the current. Waste heat is rejected from the collector electrode. An experiment was carried out with a high power laser using a cesium vapor TELEC cell with 30 cm active length. Laser supported plasma were produced in the TELEC device during a number of laser runs over a period of several days. Electric power from the TELEC was observed with currents in the range of several amperes and output potentials of less than 1 volt. M.G.

N83-15865*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIRECT CONVERSION OF INFRARED RADIANT ENERGY FOR SPACE POWER APPLICATIONS Final Report
Robert C. Finke *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 22 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10B

A proposed technology to convert the earth radiant energy (infrared albedo) for spacecraft power is presented. The resultant system would eliminate energy storage requirements and simplify the spacecraft design. The design and performance of a infrared rectenna is discussed. M.G.

N83-15866*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
THE PHOTOTRON: A LIGHT TO RF ENERGY CONVERSION DEVICE Final Report
John W. Freeman and Sedgwick Simons *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 17 p refs (For primary document see N83-15860 06-44)
(Grant NAG3-29)
Avail: NTIS HC A99/MF A01 CSCL 10A

The phototron, a photoelectric device that converts light to radio frequency energy, is described. It is a vacuum tube, free electron, device that is mechanically similar to a reflex klystron with the hot filament cathode replaced by a large area photocathode. The device can operate either with an external voltage source used to accelerate the photoelectrons or with zero bias voltage; in which case the photokinetic energy of the electrons sustains the R.F. oscillations in the tuned R.F. circuit. One basic design of the phototron was tested. Frequencies as high as about 1 GHz and an overall efficiency of about 1% in the biased mode were obtained. In the unbiased mode, the frequencies of operation and efficiences are considerably lower. Success with test model suggests that considerable improvements are possible through design refinements. One such design refinement is the reduction of the length of the electron flight path. M.G.

N83-15867*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RADIATION-DRIVEN MHD SYSTEMS FOR SPACE APPLICATIONS Final Report
Ja H. Lee (Vanderbilt Univ.) and Nelson W. Jalufka *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 11 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10A

High-power radiation such as concentrated solar or high-power laser radiation is considered as a driver for magnetohydrodynamic (MHD) systems which could be developed for efficient power generation and propulsion in space. Eight different systems are conceivable since the MHD systems can be classified in two: plasma and liquid-metal MHD's. Each of these systems is reviewed and solar- (or laser-) driven MHD thrusters are proposed. Author

N83-15868*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
INTERACTION BETWEEN THE SPS SOLAR POWER SATELLITE SOLAR ARRAY AND THE MAGNETOSPHERIC PLASMA Final Report **c15**
John W. Freeman *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 18 p refs (For primary document see N83-15860 06-44)
(Contract NAS8-33023)
Avail: NTIS HC A99/MF A01 CSCL 10A

The results of study to determine the effects of space plasmas on a large GaAs solar cell array using solar reflectors at a concentration ratio of two in geostationary orbit are summarized. It was concluded that the system could function in the GEO environment if certain design changes were implemented. These included conductive coatings on the solar cells, changing the reflector material from Kapton to a higher conductivity material, and oversizing the array to compensate for a 0.7% parasitic load due to losses from the ambient magnetospheric plasma. The operation of the solar powered earth orbit transfer vehicle (EOTV) was also examined and it was concluded that LEO servere arcing would take place on all high voltage negative portions of the array. The parasitic load loss at LEO was estimated at 3%. Operation of a high voltage array at LEO represents a major problem. Charge exchange ion feedback from argon ion thrusters located near the EOTV solar array was also examined and all problems found were believed to be solvable by the placement of protective ground screens. M.G.

N83-15869# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OVERVIEW OF HIGH-TEMPERATURE MATERIALS FOR HIGH-ENERGY SPACE POWER SYSTEMS Final Report
Neal T. Saunders *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 39 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10B

The current state of technology and some of the more pressing research needs and challenges associated with the possible use of high temperature materials in future high energy space power systems are discussed. Particularly, emphasis is on the need to improve and quantify the fundamental understanding of the effects of the following: (1) fast neutron radiation on the properties and behavior of nuclear reactor fuels and claddings; and (2) long term, high temperature, space (vacuum) exposure on the properties of refractory metals considered for use as structural materials in various power conversion systems. M.G.

N83-15870# Arizona State Univ., Tempe. Dept. of Mechanical and Energy Systems Engineering.
SOME MATERIAL IMPLICATIONS OF SPACE NUCLEAR REACTORS (NON-FUEL MATERIALS) Final Report
James F. Morris *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 13 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10A

Nonfuel materials for space nuclear reactors, high temperature alloys and electric isolators are discussed. M.G.

N83-15871# General Atomic Co., San Diego, Calif.
NUCLEAR FUEL SYSTEMS FOR SPACE POWER APPLICATION Final Report
Ling Yang *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 26 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10A

Work carried out on in-core thermionic fuel-cladding development has indicated that the uranium carbide-tungsten and the uranium oxide-tungsten fuel systems are promising candidates. Materials and fabrication techniques were developed to meet the requirements of the thermionic fuel elements. Out-of-pile and in-pile studies of fuel-cladding compatibility, dimensional stability, and thermionic performance stability were performed for both fuel systems. Accelerated irradiation tests attained a burnup of 3 x 10 to the 20th power fissions/cu cm for the carbide and the oxide fueled emitters at 1900 K, which is equivalent to that for 40,000 hours of operation of 120 ekw thermionic reactor. Prototypical carbide and oxide fueled emitters were tested for 8000 hours at 1740 to 1840 K. Comparatively speaking, the carbide-fueled system exhibited greater dimensional stability than the oxide-fueled system, while the oxide-fueled system exhibited better thermionic performance stability than the carbide-fueled system. The experiences gained in the development of coated fuel particles for the high temperature, gas-cooled reactor are described and the potential of such coated fuel particles for space power application is discussed. M.G.

N83-15872# Westinghouse Research and Development Center, Pittsburgh, Pa.
MATERIALS FOR HIGH POWER MHD SYSTEMS Final Report
Barry R. Rossing *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 19 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10A

Electrode and insulator materials requirements for high power magnetohydrodynamic power generators are discussed. Open and closed cycle linear generators are emphasized. Author

N83-15873# Westinghouse Research and Development Center, Pittsburgh, Pa.
THE WESTINGHOUSE HIGH FLUX ELECTRON BEAM SURFACE HEATING FACILITY (ESURF) Final Report
Martin D. Nahemow *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 7 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10A

The ESURF facility located, at the Westinghouse Electric Corp., Research and Development Center, Pittsburgh, Pennsylvania is described. It was first used to test cathodes for a BNL designed negative ion source. The water cooled copper cathodes were operated at a loading of 2 KW/sq cm steady state loading. Divertor collector targets for the MIT divertor program were subject to transient conditions. These molybdenum tubes were subject to up to 500 2 kW/sq cm transients. The facility is currently being used in a first wall/blanket/shield engineering test program for the Argonne National Labs. The ESURF uses a 50 KW 150 KeV electron beam as a heat source. The scan logic permits a wide variety of transient and steady state thermal effects to be modeled. The system cooling loop has a maximum operating pressure of 1000 psi. The pumps have an operating range from 7 gpm at a 700 ft head to 30 gpm at a 500 ft head. 40 KW of preheat and 100 KW of subcooling are provided. Temperature, pressure, flow, strain, etc. are measured and controlled. The system has a TI microprocessor control system linked to a LSI/11 computer system for control, data acquisition, and data processing. B.W.

N83-15874# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
APPLICATIONS OF A HIGH TEMPERATURE RADIATION RESISTANT ELECTRICAL INSULATION Final Report c33
M. H. Cooper *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 16 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 09A

Electrical components are being developed for service inside the reactor vessel of Fast Breeder Reactors. These components will function in an exceptionally hostile environment combining high temperature (1000 F), chemical activity (liquid sodium), and nuclear radiation (fast neutron fluences to 1021 n/sq cm). Two components which are being developed are an electromagnetically actuated shutdown system and an induction motor. The successful development of a glass-alumina insulation which is suitable for operation at high temperature and in high radiation fields is the key technological advance that has resulted in the development of these components. The insulation is applied by a dipping process similar to conventional enamel insulation utilizing a slurry of glass-alumina in an organic binder. Drying at modest temperature results in a green flexible coating that is adherent to the wire. After the wire is formed into the desired component, the wire is fired at high temperature to eliminate the binder and to fuse the glass mixture to the wire. Electromagnetic coils thus fabricated have been operated for more than 18 months in sodium systems from 850 to 1100 F. Author

N83-15875# Brookhaven National Lab., Upton, N. Y.
RADIATION DAMAGE MEASUREMENTS ON NONMETALS MADE DURING IRRADIATION WITH 1 TO 3 MeV ELECTRONS Final Report c72
Paul W. Levy *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 12 p refs (For primary document see N83-15860 06-44) (Contract DE-AC02-76CH-00016)
Avail: NTIS HC A99/MF A01 CSCL 20H

To investigate the fundamental processes producing radiation damage in nonmetals a unique facility has been developed for making optical absorption, luminescence and other measurements during irradiation with 1 to 3 MeV electrons. Measurements are made with a 13 meter long double beam spectrometer arranged so that all sensitive components, e.g., phototubes, are outside of the irradiation chamber. A computer provdies automatic control and data recording. A 256 point absorption and a 256 point luminescence spectra are recorded as often as every 40 seconds in either the 200-400 or 400-800 mm wavelength range. Samples are irradiated, at temperatures between 20 and 900 C, in an electronically controlled chamber containing He exchange gas and equipped with thin Havar windows to transmit the electron beam and high purity fused silica windows for the spectrophotometer beams. Radiation induced luminescence and absorption in the chamber windows, etc. is eliminated by the double beam spectrophotometer. Studies made with this equipment demonstrate clearly that many of the processes occurring during damage formation are transient. Author

N83-15876# State Univ. of New York at Buffalo, Amherst.
CHARGE INJECTION EFFECTS UPON PARTIAL DISCHARGES IN A dc AND dc PLUS ac LAMINATE INSULATION ENVIRONMENT Final Report c33
W. J. Sarjeant, J. R. Laghari, R. Gupta, and K. J. Bickford (LASL, N. Mex.) *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 31 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 09C

Foil-edge partial discharge phenomena in liquid impregnated Laminate structures have been investigated. A partial dicharge dependency on V has been found to exist. Experiments support the hypothesis that electric charges are injected into the dielectric regions near the conductor edge by field-controlled charge injection during impressed voltage transients. The resulting conduction current space charge can establish equilibrium by reduction of the electric field intensity below the partial discharge inception threshold. A temporal characterization of this space charge injection is discussed relative to the effect on partial discharge inception at the foil edge. The significance of these effects in general insulation

configurations having a combination of solid-liquid-gas-vacuum interfaces will be discussed in some detail. Author

N83-15877# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEEP IMPURITY TRAPPING CONCEPTS FOR POWER SEMICONDUCTOR DEVICES Final Report c76
Gale R. Sundberg *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 39 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20L

High voltage semiconductor switches using deep impurity doped silicon now appear feasible for high voltage (1-100 kV), high power (>10 Kw) switching and protection functions for future space power applications. Recent discoveries have demonstrated several practical ways of gating deep impurity doped silicon devices in planar configurations and of electrically controlling their characteristics, leading to a vast array of possible circuit applications. A new family of semiconductor switching devices and transducers are possible based on this technology. New deep impurity devices could be simpler than conventional p-n junction devices and yet use the same basic materials and processing techniques. In addition, multiple functions may be possible on a single device as well as increased ratings. Author

N83-15878# Spire Corp., Bedford, Mass.
APPLICATIONS OF MATERIALS SURFACE MODIFICATION TO PRIME POWER SYSTEMS Final Report
F. L. Milder *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 14 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10A

The new technologies of surface modification are ideally suited for space applications. Surface modification offers the ability of custom creating materials with one set of surface properties conjoined to a dissimilar or even mutually exclusive set of bulk properties. The benefit of such specifically engineered materials is an efficiency in component design which translates to weight minimization. Modern surface modification techniques, including ion implantation, sputter deposition, and plasma/ion deposition, deal with thin film layers in the range from a few nanometers to a few micrometers. Ion implantation is unique in that it forcibly injects an element of choice into the near surface region of a material. Thus, alloys or solid solutions are formed unaccompanied by dimensional changes. The numerous and varied deposition techniques, on the other hand, grow coating layers, often with unique properties. B.W.

N83-15879# Spire Corp., Bedford, Mass.
IN SITU MONITORING OF CRITICAL SYSTEM COMPONENT EROSION BY NUCLEAR ACTIVATION TECHNIQUES Final Report c72
F. L. Milder *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 14 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20H

Surface layer activation is a nuclear material loss measurement technique capable of measuring minute amounts of wear, erosion, or corrosion in situ. Possible applications in the area of prime power would concern parts subject to erosion in MHD and plasma sources, corrosion studies of electrodes, wearing parts in rotating generators and pitting studies of spark gap switches. The technique could be utilized in development stage experiments or in order to monitor component health in space. Author

N83-15880*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GROWTH OF DIAMONDLIKE FILMS FOR POWER APPLICATIONS Final Report
B. Banks *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 33 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10B

Diamond has a high thermal conductivity (approximately 5 times that of copper) and is an ideal heat sink material for high power semiconductor devices as well as being of interest as a semiconductor material. Numerous vacuum deposition processes are being evaluated by NASA-LeRC which have demonstrated the capability to deposit carbon films having some of the properties of diamond. Current activities include Investigation of high deposition rate vacuum processes suitable for synthesis of diamondlike carbon films. The results of recent film characterization tests are reported. Author

N83-15881# Naval Research Lab., Washington, D. C.
CERAMICS FOR HIGH POWER SOURCES IN SPACE Final Report
Roy W. Rice *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 23 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10A

The general potential issues, and forms, of using ceramics in high power sources in space are first briefly reviewed; then some specific examples of using ceramics in energy systems are outlined. Next general ceramic research needs are discussed followed by a discussion of the research opportunities that are seen for ceramics; namely ceramic composites, fiber/whisker processing (especially by polymer pyrolysis), ternary and higher order compounds, and mimicking certain natural fiber-or biostructures. Author

N83-15882*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MATERIALS TECHNOLOGY FOR LARGE SPACE STRUCTURES Final Report c18
Charles P. Blankenship and Darrel R. Tenney *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 38 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 22B

Several of the key material technology needs that were identified for large space structures are outlined. They include lightweight structural materials, materials durability in the space environment, and some special aspects of materials fabrication technology. Examples of current materials research directed toward large space structures are described. Additional research needs and opportunities are noted. A short bibliography is included of selected references that describe large space structural concepts and related technology needs in detail. R.J.F.

N83-15883# Naval Research Lab., Washington, D. C. Lab. for the Structure of Matter.
STRUCTURAL CHARACTERIZATION OF MATERIALS FOR HIGH ENERGY SPACE SYSTEMS Final Report
Richard Gilardi *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 20 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10B

A review is given describing the use of diffraction techniques for the characterization of the atomic arrangements of materials in the amorphous, crystalline and fibrous forms. This research relates structure to function or to physical and chemical properties. The techniques of X-ray, neutron and electron diffraction are employed. The resulting diffraction patterns are transformed into detailed structural information. An additional special technique involves the use of synchrotron radiation. It is of particular significance to studies of small samples, surfaces and anomalous dispersion applications. R.J.F.

N83-15884# Princeton Univ., N. J.
RECENT ADVANCES IN MOLECULAR DYNAMICS Final Report c72
Herschel Rabitz *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 34 p refs (For primary document see N83-15860 06-44)

Avail: NTIS HC A99/MF A01 CSCL 07D

A summary of current basic research directions in the field of molecular dynamics is given and the present capabilities in the field are illustrated. The words molecular dynamics refer to atoms, molecules or ions which are undergoing changes due to interactions with their environment typically by collisions or radiative processes. Some key activities in the field are summarized. Reaction kinetics, transport properties, molecular interactions, and various equations are among the topics discussed. R.J.F.

N83-15885# Los Alamos Scientific Lab., N. Mex. Chemistry-Materials Science Div.

CHEMICAL PHYSICS OF VAPORIZATION, CONDENSATION AND GAS-SURFACE ENERGY EXCHANGE Final Report c25

Gerd M. Rosenblatt *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 32 p refs (For primary document see N83-15860 06-44)

Avail: NTIS HC A99/MF A01 CSCL 10A

Current understanding of the rates and atomistic mechanisms of vaporization and condensation is discussed. Recent results on the dynamics of gas-surface interactions are reviewed, with an emphasis upon the degree of energy accommodation, both translational and internal, which occurs when molecular gases interact with solid surfaces. R.J.F.

N83-15886# General Atomic Co., San Diego, Calif.

THERMIONIC CONVERSION FOR SPACE POWER APPLICATION Final Report

Ling Yang and Gary O. Fitzpatrick *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 16 p refs Prepared in cooperation with Rasor Associates, Inc., Sunnyvale, Calif. (For primary document see N83-15860 06-44)

Avail: NTIS HC A99/MF A01 CSCL 10B

Efforts to develop thermionic conversion for space power application are discussed. Tungsten, niobium and Al2O3 were selected as the emitter, collect and insulator materials for the converter. Uranium carbides and uranium oxide were selected as candidates for the nuclear fuel. A total of 36 fueled thermionic converters and fuel elements were life-tested during 1965 to 1972. These tests, supported by a dozen converter tests and several material irradiation tests, provided the base of the in-core thermionic technology. Unfueled converters demonstrated a life of five years or more, while fueled converter fuel elements have been operated for one to one and one-half years. The major limiting factors for converter life and performance were: component diffusion through cladding and emitter cracking for carbide-fueled converters, and emitter swelling for the oxide-fuel converters. Various means for mitigating the fuel effects on converter life and performance were proposed but they were not thoroughly evaluated. R.J.F.

N83-15887# Thermo Electron Corp., Waltham, Mass.

THERMIONIC TECHNOLOGY FOR SPACECRAFT POWER: PROGRESS AND PROBLEMS Final Report

Fred Huffman, David Lieb, Peter Reagan, and Gabor Miskolczy *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 30 p refs (For primary document see N83-15860 06-44)

Avail: NTIS HC A99/MF A01 CSCL 10B

Thermionic conversion for use with space reactors is discussed. Advantages are discussed, as well as development problems. The mechanical simplicity associated with no moving parts implies reliability. The high temperature of heat rejection minimizes the mass of the radiator - which is usually the heaviest component of large space power systems. The high heat rejection temperature also limits the size of the radiator, which is an important consideration, since all space reactor systems in the foreseeable future must fit inside the space shuttle bay. Modularity maximizes reliability by eliminating single point system failures. In addition, thermionics is a demonstrated conversion technology coupled to nuclear reactors. Although available thermionic converter performance yields systems with attractive specific masses of around 20 kG/kWe, higher efficiency and power density are certainly desirable. For space systems, this improvement must accrue from reduced potential losses in the interelectrode plasma since the radiator temperature will be too high to take advantage of collector work functions lower than those already available. R.J.F.

N83-15888# Carnegie-Mellon Univ., Pittsburgh, Pa.

A SURVEY OF RECENT ADVANCES IN AND FUTURE PROSPECTS FOR THERMIONIC ENERGY CONVERSION Final Report

John Lawless *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 8 p (For primary document see N83-15860 06-44)

Avail: NTIS HC A99/MF A01 CSCL 10B

Some powerful advances in the fundamental understanding of Thermionic Conversion are discussed. Those include numerical computer simulations and simple analytical models. As a consequence of these advances, many new ideas are being developed with the potential for major improvements in thermionic converter performance. In particular, structured electrodes and oscillation effects now show strong possibilities for important improvements. Further, modeling techniques now exist to consider pore converters and third electrode converters in detail whereas past studies were mainly empirical. In summary, greatly superior performance can be expected from future thermionic converters. R.J.F.

N83-15889# Grumman Aerospace Corp., Bethpage, N.Y.

THERMAL MANAGEMENT OF LARGE PULSED POWER SYSTEMS Final Report

Bob Haslett *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 36 p refs (For primary document see N83-15860 06-44)

Avail: NTIS HC A99/MF A01 CSCL 10B

Current thermal control technology is reviewed and limitations assessed compared to a typical high pulse power application. Thermal management is a significant weight factor (approximately 50%) of even medium power systems which points to a large potential payback from innovative techniques. Thermal research is recommended in the areas of concentrating and thermovoltaic solar arrays, two phase heat transport loops, direct contact heat exchangers and advanced radiator systems. Air Force space power trends indicate requirements for systems with 10 to 200 KW average power with pulse/average power ratios of 10/1 to 1000/1. Thermal system definition is complicated by the variety of possible power systems although solar and nuclear (Brayton and Thermionic) appear to be the leading candidates. R.J.F.

N83-15890# Washington Univ., Seattle.

THE LIQUID DROPLET RADIATOR Final Report c34

A. T. Mattick, A. Hertzberg, and R. Taussig (Mathematical Sciences Northwest, Inc., Bellevue, Wash.) *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 15 p (For primary document see N83-15860 06-44)

Avail: NTIS HC A99/MF A01 CSCL 20D

A new type of radiator which uses a recirculating stream of liquid droplets as a radiation element in place of the solid surfaces used in conventional tube and fin space radiators is discussed. By virtue of the large surface to volume ratio of small droplets the liquid droplet radiator (LDR) has the potential of being many times lighter than the lightest solid surface radiator yet developed (heat pipes). In addition the LDR may be much more simply and economically deployed since the radiating element is transported as a liquid. Preliminary studies of the physics and engineering of the LDR have not revealed any exceptional obstacles to development of a practical LDR based on existing technology. Generation of droplets may utilize the methods developed for ink-jet printing, and collection devices using rotation to simulate gravity appear workable. Liquids were identified which have low enough vapor pressures that evaporation losses over durations of tens of years are tolerable. Liquid tin is best for heat rejection between 500 K

and 1000 K, tin eutectics between 370 K and 600 K, and silicone oils between 260 K and 400 K. R.J.F.

N83-15891# Washington Univ., Seattle.
THE LIQUID DROPLET HEAT EXCHANGER Final Report c34
A. P. Bruckner *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 12 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20D

Direct contact heat exchange between a gas and a molten metal dispersed into droplets offers an attractive new approach to increasing the efficiency and decreasing the specific weight of thermal power cycles for space applications. The ability of a droplet heat exchanger to transfer heat directly from a liquid metal to a working gas over a wide temperature range circumvents many of the material limitations of conventional tube type heat exchangers and does away with complicated plumbing systems and their tendency toward simple point failure. Droplet heat exchangers offer large surface to volume ratios in a compact geometry, very low pressure drop and high effectiveness. In the simplest configuration the molten material is sprayed axially through a counterflowing, high pressure inert working gas in an insulated cylindrical chamber. The droplets transfer heat directly to the gas by convection as they traverse the heat exchanger and are subsequently collected for recycling through the heat source. A number of suitable liquid metals and eutectic alloys having negligibly low vapor pressures in the temperature range of 350-1300 K were identified. Experimental studies of droplet formation with mercury demonstrated that near perfect control of droplet size can be easily achieved. R.J.F.

N83-15892# Thermacore, Inc., Lancaster, Pa.
THE NEED FOR IMPROVED HEAT PIPE FLUIDS Final Report c34
D. M. Ernst and G. Y. Eastman *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 15 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20D

Low mass high performance radiators and thermal management systems for advanced space systems are discussed. The key to these new improved thermal systems are high performance heat pipes. One aspect in achieving low mass/high performance heat pipes requires working fluids compatible with low mass materials of construction, such as aluminum, magnesium, beryllium and titanium. The application of heat pipe systems in manned spacecraft also requires the use of low or nontoxic working fluids. The development of new or improved heat pipe fluid/vessel combinations for advanced space systems should be carried out. Two approaches worthy of investigation are: the synthesis of new high performance fluids compatible with appropriate envelope materials and the development of integral impervious coatings and/or passivation to prevent the reaction of currently acceptable working fluids with the envelope. R.J.F.

N83-15893# Thermacore, Inc., Lancaster, Pa.
ENHANCED HEAT PIPE THEORY AND OPERATION Final Report c34
D. M. Ernst and G. Y. Eastman *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 24 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20D

Heat pipes to extract heat from the cores of compact fast reactors are discussed. They require unusually high power densities. This performance appears to be feasible, but necessitates more detailed exploration of theoretical and operational limits than has then carried out to date. Closely aligned to heat pipes for heat removal from the core are the low mass high performance, high temperature radiator heat pipes. The areas requiring the greatest attention are the startup and shutdown characteristics of long heat pipes, the limits on wick augmented thin film evaporation (burn out heat flux) and the prediction of the true temperature profile along the heat pipe. It will also almost certainly require exploration and analysis of higher capacity capillary wicks. R.J.F.

N83-15894# Little (Arthur D.), Inc., Cambridge, Mass.
TWO-PHASE HEAT TRANSPORT FOR THERMAL CONTROL Final Report c34
A. A. Fowle *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 18 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20D

The concept of the pumped, two phase flow heat transport system is discussed. The system consists of a closed fluid loop maintained in circulation by a pump. The fluid is preconditioned in a supply reservoir to be near saturation at a temperature level best suited to provide the heat source or sink necessary to the temperature control of the subsystems on the loop. A liquid vapor, two phase, saturated mixture of the working liquid is made to flow through heat stations (instrument modules in the case shown) arranged in series along the flow loop. Heat exchange at the heat stations involves change of phase, either condensation or evaporation, depending on whether cooling or heat addition is required. The net heat added by all instrument modules is rejected by a space radiator. The radiator functions as a condenser and is sized to handle the largest net heat addition to the fluid loop occurring during operation of the system. A temperature controlled fluid bypass and mixing valve (or other means) establishes the set point temperature of the fluid in the reservoir slightly below the saturation temperature corresponding to its pressure. The pump inlet is, therefore, supplied with slightly subcooled liquid from the reservoir to minimize the power required to circulate the fluid in the loop and to avoid cavitation induced difficulties. R.J.F.

N83-15895# Little (Arthur D.), Inc., Cambridge, Mass.
LIQUID RIBBON RADIATOR FOR LIGHTWEIGHT SPACE RADIATOR SYSTEMS Final Report c34
W. P. Teagan *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 13 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20D

The liquid metal ribbon (CMR) radiator concept described operates by forming a thin (10-100 micrometers) liquid metal meniscus on a wide mesh screen structure which is drawn through space by a retractable pulley system. The liquid metal bath from which the liquid metal ribbon is formed can be a heat dissipation sink for a spaceborne power system or space thermal control system. Preliminary analysis indicates that radiators formed in this way show promise of achieving weights one tenth to one fourth those of conventional space radiators utilizing heat pipe configurations. Film materials which have been combined include gallium, tin, and lithium. These materials cover a wide range of potential heat rejection temperature needs. Author

N83-15896# Argonne National Lab., Ill.
SOFTWARE FOR COMPARISON AND OPTIMIZATION OF POWER SYSTEMS Final Report c61
Greg Berry *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 14 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 09B

Interest in examining alternative power system concepts have increased recently. Such analysis have become very involved, regardless of the degree of sophistication employed in modeling the individual component models of the system or the extent of the property data base used. The systems code presented herein has been designed for the nonexpert user by the development of a sophisticated language translator and executive code preprocessor. These two modules also permit great flexibility in allowing the user to specify the system in his own style rather than conforming to a rigid structure determined by a precompiled computer code. This paper will also be concerned with the solution procedures available. The systems code uses Powell's hybrid method for solving N-dimensional nonlinear equations and Brent's method for a 1 dimensional equation. Powell's variable metric

constrained method is used for N-dimensional nonlinear optimization and Brent's method for the optimization of one variable. B.W.

N83-15897# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
UNCERTAINTIES IN THERMAL-STRUCTURAL ANALYSIS OF LARGE SPACE STRUCTURES Final Report c39
Earl A. Thornton *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 17 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20K

Uncertainties in the thermal structural analysis of large space structures are briefly described. Thermal structural design challenges faced by structural engineers are highlighted. Some basic questions arising in predictive analyses are identified and illustrated with recent research. Areas for further research are discussed, and the need for fundamental thermal structural experiments is cited. Author

N83-15898# Layton (J. Preston), Princeton Junction, N.J.
POWER CONVERSION: OVERVIEW Final Report
J. Preston Layton *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 23 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 10B

The central position of power conversion systems in relation to other elements of space power systems is identified and the recognized types of power conversion are shown to be: photovoltaic, thermoelectric, Brayton cycle, Rankine cycle, Stirling cycle, thermionic and electromagnetic. The requirement for space electric power levels versus calendar years are presented historically and projected beyond the turn of the century. A number of space power systems that may employ thermoelectric, Brayton, Rankine and magnetohydrodynamic power conversion are illustrated and discussed. The need for mission and systems analyses to support the identification of applied research in power conversion is argued and the approach for conducting these analyses is presented. Author

N83-15899# Army Construction Engineering Research Lab., Champaign, Ill. Energy Systems Div.
OVERVIEW OF PASSIVE SOLAR DESIGN TECHNIQUES Final Report
David M. Joncich Sep. 1982 43 p refs
(AD-A119993; CERL-SR-E-179) Avail: NTIS HC A03/MF A01 CSCL 13/1

This report presents an overview of the fundamental terminology, concepts, and techniques related to passive solar technology, and provides examples of passive strategies which can be incorporated into the inventory of Army buildings. GRA

N83-15900# Power Conversion, Inc., Elmwood, N.J.
PRIMARY LITHIUM ORGANIC ELECTROLYTE BATTERY BA-5588 Final Report, Apr. 1979 - Jan. 1981
M. G. Rosansky Jul. 1982 101 p refs
(Contract DAAK20-79-C-0260)
(AD-A120858; DELET-TR-79-0260-F) Avail: NTIS HC A06/MF A01 CSCL 10/3

This program concerns the development, fabrication and evaluation of a Lithium organic electrolyte battery designated BA-5588 ()/U which incorporates five series connected, hermetically sealed cells housed in a plastic case. Significant effort was directed towards cell optimization through controlled experimentation and evaluation of various design parameters. Demonstration of the effectiveness of the finalized design was accomplished by the performance of various electrical and abuse tests which included environmental exposure, prolonged thermal storage, electrical discharge under various thermal profiles, short circuit and discharge to zero volts as well as forced discharge. The resulting evaluation demonstrated the batteries ability to operate safely under all of the specified abusive environments and provide 100% of the specified service life requirements. Author (GRA)

N83-15901# Gould, Inc., Rolling Meadows, Ill. Materials Lab.
STUDIES LEADING TO THE DEVELOPMENT OF HIGH-RATE LITHIUM-SULFURYL CHLORIDE BATTERY TECHNOLOGY Quarterly Report, 1 Apr. - 30 Jun. 1982
John C. Hall and Mark Koch Oct. 1982 50 p
(Contract DAAK20-81-C-0420; DA Proj. 1L1-62705-AH-94)
(AD-A120853; DELET-TR-81-0420-3; QR-3) Avail: NTIS HC A04/MF A01 CSCL 10/3

The overall aim of the program is an examination of the viability of an active electrolyte lithium-sulfuryl chloride battery system. The specific objectives are: quantify the stability of lithium in sulfuryl-chloride based electrolyte. Develop means to stabilize in the lithium anode in sulfuryl chloride based electrolyte to meet Army storage requirements. Establish the performance limits of Li/SO2Cl2 cells with respect to cathode and electrolyte composition. GRA

N83-15902# Naval Weapons Center, China Lake, Calif.
FLAT PLATE PHOTOVOLTAIC POWER SYSTEMS: DESCRIPTION, DESIGN AND COST
Michael R. Hall, Garyl D. Smith, and David L. Holmes Jul. 1982 121 p refs
(AD-A120814; NWC-TP-6381) Avail: NTIS HC A06/MF A01 CSCL 10/2

The Energy Program Office at the Naval Weapons Center has been tasked to manage the Department of the Navy's photovoltaic effort. This effort includes participation in the Federal Photovoltaic Utilization Program (FPUP), which is sponsored by the Department of Energy, and encouragement of worldwide Navy activities to use Navy funds to procure cost-effective photovoltaic power systems. This report describes in simple nontechnical terms what photovoltaic power systems are, how they are sized, their costs, and their advantages and disadvantages. It also includes all tables and information necessary for the nontechnical person to determine preliminary sizes and costs of photovoltaic power systems for most applications. Navy activities can identify cost-effective applications for photovoltaic power systems by using this report and can procure the systems on their own or seek assistance from the Energy Program Office. The Energy Program Office will assist in preparing procurement specifications, evaluating proposals, awarding and monitoring contracts, and acceptance-testing the systems. Author (GRA)

N83-15903# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
PRELIMINARY ANALYSIS OF WAVE ENERGY CONVERSION AT AN OFFSHORE STRUCTURE Final Report
A. Douglas Carmichael, D. Assanis, and J. O. Salsich Sep. 1982 55 p refs
(Contract MIPR-Z-700999-1-00886)
(AD-A120079; USCG-D-65-81) Avail: NTIS HC A04/MF A01 CSCL 10/1

A study of the feasibility of utilizing wave energy to provide the electrical power to operate the Buzzards Bay Light Tower has been carried out. It was concluded that a pneumatic buoy attached to the light tower would be the best solution. Experiments were conducted in the MIT Towing Tank to estimate the performance of such a device. The loads imposed by the wave energy device on the power during an extreme storm were estimated and were predicted to be very large. Theoretical and experimental studies have indicated a possible method of reducing the size of the wave energy device by controlling the air pressure in the buoy. Author (GRA)

N83-15904# Air Force Academy, Colo.
SIMPLIFIED SOLAR FRACTION ESTIMATION FOR SPACE AND WATER HEATING AT DEPARTMENT OF DEFENSE INSTALLATIONS. APPENDIX C: WATER HEATING NOMOGRAPHS Final Report
Nelson S. Pacheco, Daniel G. Kniola, James F. Sheedy, and Robert J. Scari Sep. 1982 201 p refs

(AD-A120014; USAFA-TR-82-6-App-C) Avail: NTIS HC A10/MF A01 CSCL 13/1

This report contains a set of nomographs which can be used to estimate the average annual solar fraction for solar space and water heating at a large number of DOD facilities. The solar fraction estimated from the nomograph is in close agreement with F-Chart 3.0 and allows for variation of the following parameters: annual load, collector area, collector transmittance-absorptance coefficient, and collector overall loss coefficient. GRA

N83-15905# Air Force Academy, Colo.
SIMPLIFIED SOLAR FRACTION ESTIMATION FOR SPACE AND WATER HEATING AT DEPARTMENT OF DEFENSE INSTALLATIONS. APPENDIX B: SPACE HEATING NOMOGRAPHS Final Report
Nelson S. Pacheco, Daniel G. Kniola, James F. Sheedy, and Robert J. Scari Sep. 1982 205 p refs
(AD-A120013; USAFA-TR-82-6-App-B) Avail: NTIS HC A10/MF A01 CSCL 13/1

This report contains a set of nomographs which can be used to estimate the average annual solar fraction for solar space and water heating at a large number of DOD facilities. The solar fraction estimated from the nomograph is in close agreement with F-Chart 3.0 and allows for variation of the following parameters: annual load, collector area, collector transmittance-absorptance coefficient, and collector overall loss coefficient. GRA

N83-15906# Air Force Academy, Colo.
SIMPLIFIED SOLAR FRACTION ESTIMATION FOR SPACE AND WATER HEATING AT DEPARTMENT OF DEFENSE INSTALLATIONS Final Report
Nelson S. Pacheco, Daniel G. Kniola, James F. Sheedy, and Robert J. Scari Sep. 1982 27 p refs
(AD-A120012; USAFA-TR-82-6) Avail: NTIS HC A03/MF A01 CSCL 13/1

This report contains a set of nomographs which can be used to estimate the average annual solar fraction for solar space and water heating at a large number of DOD facilities. The solar fraction estimated from the nomograph is in close agreement with F-Chart 3.0 and allows for variation of the following parameters: annual load, collector area, collector transmittance absorption coefficient, and collector overall loss coefficient. GRA

N83-15907# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Offshore Energy Technology.
STUDIES LEADING TO THE DEVELOPMENT OF HIGH-RATE LITHIUM SULFURYL CHLORIDE BATTERY TECHNOLOGY Quarterly Report, 1 Jan. - 31 Mar. 1982
John C. Hall and Mark Koch Sep. 1982 58 p refs
(Contract DAAK20-81-C-0420; DA Proj. 1L1-62705-AH-94)
(AD-A120002; DELET-TR-81-0420-2; QR-2) Avail: NTIS HC A04/MF A01 CSCL 10/3

The overall aim of the program is an examination of the viability of an active electrolyte lithium sulfuryl chloride battery system. The specific objectives are: (1) quantify the stability of lithium in sulfuryl chloride solution; (2) explore means to stabilize lithium in sifuryl chloride; (3) establish the limits of performance of carbon/teflon cathodes. During the second quarter we: continued characterization of anode stability with respect to cell design and electrolyte composition, determined the voltage delay after storage as a function of electrolyte composition, and characterized the performance at room temperatures of cells with and without performance additives. We found that positive grounding or floating of both electrodes with respect to the case enhance anode stability, the bromine performance additive increases anode stability, the bromine performance additive decrease voltage delay, and the bromine performance additive is superior to the chlorine performance additive in terms of delivered capacity. GRA

N83-15908# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
FIFTH BIENNIAL WIND ENERGY CONFERENCE AND WORKSHOP (WW5)
Irwin E. Vas, ed. (Flow Industries, Inc.) 1981 539 p refs Conf. held in Washington, D.C., 5-7 Oct. 1981 Sponsored by DOE
(DE82-014659; SERI/CP-635-1340-Vol-1; CONF-811043-Vol-1)
Avail: NTIS HC A23/MF A01

Wind energy programs are reviewed. Results of research and development studies were presented in the areas of wind turbine technology, applications, economics, environmental, performance and wind resource. Analysis and improvements to the state of the art are discussed. For individual titles, see N83-15909 through N83-15941.

N83-15909# Department of Energy, Washington, D. C. Wind Energy Technology Div.
THE FEDERAL WIND ENERGY PROGRAM
Louis V. Divone *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 3-26 (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

The utilization and development of wind energy systems are reviewed. The future of these systems is discussed. S.L.

N83-15910# Pacific Northwest Lab., Richland, Wash.
THE WIND CHARACTERISTICS PROGRAM
L. L. Wendell *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 27-38 refs (For primary document see N83-15908 06-44)
(Contract DE-AC06-76RL-01830)
Avail: NTIS HC A23/MF A01

Wind characteristics research activities emphasize wind resource assessment, site selection and evaluation techniques, and wind characteristics for wind turbine design, performance and operations evaluation. Wind resource analysis shows the greatest area of high wind power resource is in the midsection of the U.S. High wind power is available in other sections of the country and is described in some detail on a state by state basis in twelve regional atlases. To carry the wind prospecting process to a finer scale, site selection techniques for small and large wind turbines were developed, tested, and documented. There is a broad range of sophistication and reliability in these techniques and their application must be matched with the priorities and time available for energy planning efforts. The nature of wind gustiness was evaluated statistically and modeled for calculating fatigue cycles and extreme events. S.L.

N83-15911*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE NASA LEWIS LARGE WIND TURBINE PROGRAM
R. L. Thomas and D. H. Baldwin *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 39-58 refs (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01 CSCL 10A

The large wind turbine program activities are reviewed. These activities include results from the first and second generation field machines (Mod-OA, 1, and 2), the design phase of the third generation wind turbine (Mod-5) and the advanced technology projects. The status of the WTS-4 machine is also presented. S.L.

N83-15912# Rockwell International Corp., Golden, Colo. Energy Systems Group.
ROCKY FLATS SMALL WIND SYSTEMS PROGRAM: AN UPDATE
Terry J. Healy and Darrell M. Dodge *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 59-70 (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

A test center for small wind systems developed at Rocky Flats. This center is now fully established with a complete range of system and component test capabilities. Over 25 commercially available machines were tested. The first of 14 systems development subcontracts was issued to private industry. Twelve prototypes resulting from these subcontracts are now fabricated and under evaluation. Some prototypes have undergone extensive

engineering refinement and several are now on the market. A range of activities - including a nationwide field evaluation program - which addressed institutional barriers to small wind systems use was initiated. These activites greatly increased national awareness of small wind systems potential and provided valuable information on wind systems applications, financial and product liability issues, regulatory issues and other subjects. This information is helping utilities, government agencies and various institutions incorporate small wind systems in the existing power production, financial and regulatory environment. S.L.

N83-15913# Sandia Labs., Albuquerque, N. Mex. Advanced Energy Projects Div.
VERTICAL AXIS WIND TURBINE PROGRAM
R. H. Braasch *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 71-85 refs (For primary document see N83-15908 06-44)
(Contract DE-AC04-76DP-00789)
Avail: NTIS HC A23/MF A01

Research investigations suggest that reduction in cost of energy (COE) and increases in reliability for VAWT systems are possible through changes in aerodynamic design. The basic changes desired are: (1) lower cut-in windspeed, (2) increase maximum efficiency, (3) limit maximum aerodynamic power, (4) limit peak aerodynamic torque, and (5) increase rotor rotational speed. Several basic aerodynamic experiments (2) are conducted to better understand the aerodynamics of a section operating in an unsteady, curvilinear flowfield. The experiments include blade chordwise pressure distribution and acceleration surveys, the use of blade sections designed to operate specifically in the VAWT environment (laminar flow profile), blade blowing (boundary layer control), blade cambering, and blade offset/preset pitch (incidence). S.L.

N83-15914# Department of Agriculture, College Station, Calif. Agricultural Research Service.
THE USDA AGRICULTURAL WIND ENERGY RESEARCH PROGRAM
R. N. Clark *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 85-92 refs (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

Applications of wind power in agriculture were investigated. Building heating projects were conducted using a 15-kW electrical machine to power resistant heaters, and a 4-kW cycloturbine powered a water churn to heat water. The two projects in product storage and processing provided refrigeration for short and long term storage systems. Milk was cooled at a dairy and exhaust heat from the compressor was used to preheat the hot water. In the other project, apples were cooled and stored for six months. The apple storage system incorporated an ice bank for storage during nonwind periods. The two irrigation experiments involved pumping water from a surface reuse system using a vertical axis wind turbine directly coupled to a turbine pump and wind assist pumping from a deep well by combining a wind turbine with a diesel engine. The wind assist concept saved 40% of fuel normally used in pumping the well. Economic analyses of these applications show that most individual loads on a farm are usually too short in duration to make the unit profitable. S.L.

N83-15915# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
THE SERI WIND ENERGY PROGRAM
Irwin E. Vas (Flow Industries, Inc.) *In its* Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 93-106 refs (For primary document see N83-15908 06-44)
(Contract EG-77-C-01-4042)
Avail: NTIS HC A23/MF A01

The widespread implementation of wind energy is supported by conducting research and development studies. The activities fall into three general areas-planning, management and analysis; advanced and innovative concepts; and information development. In the first area, the work conducted relates to economic, application, legal, social and environmental studies which are generic and could be applied to a wide range of machine size and type. The second area of responsibility lies with the directing and managing of advanced and innovative concepts--those high risk concepts that offer the potential of improving upon the cost of energy of conventional systems and of increasing the wide spread implementation of wind systems into populated areas. The third area of responsibility relates to the development of informational documents which are designed for specific audiences. This activity generally supports the Solar Energy Information Data Bank in their efforts to provide general information in response to inquiries on wind energy. S.L.

N83-15916*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPERATING EXPERIENCE WITH THE 200 kW MOD-OA WIND TURBINE GENERATORS
A. G. Birchenough, A. L. Saunders, T. W. Nyland, and R. K. Shaltens *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 107-118 refs (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01 CSCL 10A

The machine configuration and its advantages and disadvantages, particularly as it affects reliability are discussed. The machine performance, both availability and power output characteristics are described. The Mod-OA operational experience is documented. The characteristics of the wind energy generated, the machine performance, and the subsystem strengths and weaknesses are discussed. An assessment of the project success in fulfilling its goals and objectives is also presented. S.L.

N83-15917# WTG Energy Systems, Inc., Buffalo, N.Y.
OPERATIONAL EXPERIENCE ON MP-200 SERIES COMMERCIAL WIND TURBINE GENERATORS
Michael Rose *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 119-124 ref (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

Innovations in the areas of blade design, corrosion resistance, control philosophies and the design of critical shutdown mechanisms are discussed. A periodic variation of output power encountered on the MP2-200 and MP3-200, and a proposed solution for these oscillations are also discussed. S.L.

N83-15918# Boeing Engineering and Construction Co., Tukwila, Wash.
TEST STATUS AND EXPERIENCE WITH THE 7.5 MEGAWATT MOD-2 WIND TURBINE CLUSTER
R. A. Axell and H. B. Woody *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 143-156 (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

The Mod-2 wind turbine cluster is described. The site preparation and construction activities are discussed, and preliminary test results, status, and plans are presented. S.L.

N83-15919# General Electric Co., Philadelphia, Pa. Advanced Energy Programs Dept.
CONCEPTUAL DESIGN OF THE 6 MW MOD-5A WIND TURBINE GENERATOR
R. S. Barton and W. C. Lucas *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 157-168 (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

The MOD-5A wind turbine system must generate electricity for 3.75 c/KWH (1980) or less. During the conceptual design phase, the MOD-5A WTC system size and features were established as a result of tradeoff and optimization studies driven by minimizing the system cost of energy (COE). This led to a 400' rotor diameter size. The MCD-5A system which resulted is defined along with the operational and environmental factors that drive various portions of the design. Development of weight and cost estimating relationships and their use in optimizing the MOD-5A are discussed. The results of major tradeoff studies are also

presented. Subsystem COE contributions for the 100th unit are shown along with the method of computation. The major subsystems are described in order that the results of the various trade and optimization studies can be more readily visualized. S.L.

N83-15920# Boeing Engineering and Construction Co., Seattle, Wash.
CONCEPTUAL DESIGN OF THE 7 MEGAWATT MOD-5B WIND TURBINE GENERATOR
R. R. Douglas *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 169-181 refs (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

Similar to MOD-2, the MOD-5B wind turbine generator system is designed for the sole purpose of providing electrical power for distribution by a major utility network. The cost of electricity (COE) target is reduced from 4c/Kwhr on MOD-2 to 3c/Kwhr on MOD-5B. The MOD-5B concept studies and eventual concept studies and eventual concept selection confirmed that the program COE targets could not only be achieved but substantially bettered. Starting from the established MOD-2 technology as a base, this achievement resulted from a combination of concept changes, size changes, and design refinements. The result of this effort is a wind turbine system that can compete with conventional power generation over significant geographical areas, increasing commercial market potential by an order of magnitude. S.L.

N83-15921# Hamilton Standard, Windsor Locks, Conn. Wind Energy Systems Dept.
STATUS OF THE 4 MW WTS-4 WIND TURBINE
R. J. Bussolari *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 183-192 (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

The WTS-4 is a four megawatt, horizontal axis wind turbine. The specifications, characteristics and features of the WTS-4 are discussed. The major component such as rotor, nacelle and tower are described and their status in the fabrication phase is presented. S.L.

N83-15922# Bendix Corp., Sylmar, Calif. Energy, Environment and Technology Office.
DESCRIPTION OF THE 3 MW SWT-3 WIND TURBINE AT SAN GORGONIO PASS CALIFORNIA
S. C. Rybak *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 193-206 (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

The SWT-3 wind turbine is a microprocessor controlled three bladed variable speed upwind machine with a 3MW rating that is presently operational and undergoing system testing. The tower, a rigid triangular truss configuration, is rotated about its vertical axis to position the wind turbine into the prevailing wind. The blades rotate at variable speed in order to maintain an optimum 6:1 tip speed ratio between cut in and rated wind velocity thereby maximizing power extraction from the wind. Rotor variable speed is implemented by the use of a hydrostatic transmission consisting of fourteen fixed displacement pumps operating in conjunction with eighteen variable displacement motors. Full blade pitch with on-off hydraulic actuation is used to maintain 3MW of output power between rated wind velocity of 40 mph and the cut-out wind velocity of 55 mph. S.L.

N83-15923# West Texas State Univ., Canyon. Alternative Energy Inst.
AGRICULTURAL APPLICATION OF SWECS
Vaughn Nelson *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 227-236 refs (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

Principal applications of wind energy for agriculture are (1) farmstead power, mainly electrical, (2) building heating, (3) irrigation pumping, (4) product storage and processing, (5) hot water for residences and dairies, and (6) associated industries of agribusiness such as feedlots, fertilizer elevators, greenhouses, etc. Field experiments show that wind energy is a viable alternative, however, reliability and maintenance are still major problems. Test results of the various experiments are described. S.L.

N83-15924# United Technologies Research Center, East Hartford, Conn.
DOE/UTRC kW DEVELOPMENT PROGRAM
M. C. Cheney *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 257-270 refs (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

A 15 kW wind turbine for farm and industrial applications was developed. The design represented an extension of the 8 kW bearingless rotor wind turbine. However, several modifications were incorporated to improve the producibility, reduce costs, and improve the appearance and operating characteristics. These consisted of an integrated transmission to eliminate a separate support frame, the use of a single off the shelf turret bearing replacing the twin bearing yaw assembly, and replacing the guyed tower with a free standing tapered tower. The prototype machine has a diameter of 48 ft and uses a single phase induction generator rated at 23 kW. The hub height is 55 ft. The measured power output at the UTRC test site has been 6 kW at 5.4 m/s (12 mph) and 15 kW at 9 m/s (20 mph). The energy capture at 5.4 m/s is estimated to be 54,850 kWh. S.L.

N83-15925# Kaman Aerospace Corp., Bloomfield, Conn.
THE 40 kW INTERMEDIATE SWECS PROGRAM
B. A. Goodale *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 271-282 (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

A horizontal axis wind turbine rated at 40 kW at 9 m/s is discussed. The system has a 19.5 m (64 ft.) diameter rotor with two fiberglass blades mounted downwind of the tower at a hub height of 23 m (75 ft.). To accommodate various output configurations, a variable pitch rotor with a microprocessor controller is incorporated. The prototype is now under test. The system is briefly described and the test program and results to date are discussed. Some of the development problems encountered and corrected are discussed. The approach to commercialization of such a system is discussed, as are some of the changes to the machine considered necessary for production. R.J.F.

N83-15926# Riso National Lab., Roskilde (Denmark). Test Plant for Small Windmills.
ON THE POWER REGULATION OF SMALL WIND TURBINES BASED ON EXPERIENCE WITH SMALL DANISH WIND TURBINES
Per Lundsager *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 285-296 refs (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

The state of development of the small wind turbines on the Danish market covering a range of 10 to 55 kW, of which approximately 500 are in operation is discussed. A typical feature of Danish small wind turbines is the regulation of the power output by stalling of the rotor blades. The merits of the stall regulation are discussed with respect to both power regulation and structural design and safety. The characteristic benefits and problems are discussed in some detail and compared to those of the pitch regulation. A survey of problems in both methods to be solved by research and development work in the next few years is given. R.J.F.

N83-15927# National Taiwan Univ., Taipei.
THE WIND PROGRAM IN A TYPHOON ENVIRONMENT
Y. S. Tsao *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 297-304 (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

The present wind program in the Republic of China (including Taiwan and the off-shore islands under ROC control) is discussed. The collection of wind data in hopeful windmill sites, especially those on offshore islands and coastal areas is discussed. The installation of experimental small wind machines in the above-mentioned sites is described. For example, some small machines will be set up this year in Quemoy for pumping of irrigation water while others will be used for salt-making in the Southern Coast of Taiwan. An evaluation of available Wind energy in Taiwan is given. The assessment of the effect of typhoon on the safety, cost and operation of wind machines is discussed R.J.F.

N83-15928# Aluminum Co. of America, Alcoa Center, Pa.
ALCOA ALVAWT PROGRAM
F. M. Townsend and R. J. Falkenberg *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 311-330 (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

A review of the failure of wind turbines is given. Data from strip-chart recordings are analyzed. Numerous conclusions are drawn regarding various points of system breakdown. It is also concluded that neither the 17 meter nor the 500 kW will be ready for commercialization without another prototype of each. R.J.F.

N83-15929# National Research Council of Canada, Ottawa (Ontario).
MEASUREMENTS ON THE MAGDALEN ISLANDS VAWT AND FUTURE PROJECTS
R. J. Templin and R. S. Rangi *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 331-344 refs (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

The rotor of a 224 kW vertical axis wind turbine (VAWT) is discussed. The rebuilt rotor of the 224 kW Magdalen Islands VAWT was installed in Sept. 1979 and is operating at its design speed (36.6 rpm). Agreement between measured and theoretical performance is generally good except that maximum power may exceed theoretical predictions. Measurements of drive train losses, torque and power ripple, and rotor stresses are discussed. Although peak-to-peak cyclic stress levels are low in relation to fatigue life limits, spectral analysis of stress data indicates that the 3-per-rev component is amplified by near-resonance with the first butterfly blade mode. This resonance was subsequently de-coupled by a damped connection between the blade struts and the central column. R.J.F.

N83-15930# DAF Indal Ltd., Mississauga (Ontario).
REVIEW OF DAF INDAL VAWT COMMERCIALIZATION PROGRAMS
C. F. Wood, L. A. Schienbein, and D. J. Malcolm *In* Midwest Res. Inst. Fifth Bien Wind Energy Conf. and Workshop (WW5) 1981 p 345-356 refs Sponsored in part by the National Research Council of Canada (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

Commercialization efforts aimed at improvements in the design and manufacture of vertical axis wind turbines (VAWT) are discussed. The development and testing of a wind assisted diesel generator system is discussed. Improvements in the design of a 50 kW VAWT is discussed. The design of a 375 kW system is also discussed. A feasibility study to identify the most cost effective VAWT turbine size is discussed. R.J.F.

N83-15931# Sandia Labs., Albuquerque, N. Mex. Advanced Energy Project Div.
STATUS REPORT OF THE 17-m VAWT PROGRAM
R. O. Nellums *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 359-370 refs (For primary document see N83-15908 06-44)
(Contract DE-AC04-76DP-00789)
Avail: NTIS HC A23/MF A01

Two 17 meter, 100 kW vertical axis wind turbines are discussed. Specifications are given. Production costs are discussed, including hours of labor for various parts. Results of certification tests are given. The structural status of the VAWT's is discussed, with emphasis upon drive train and rotor stresses. R.J.F.

N83-15932# Sandia Labs., Albuquerque, N. Mex. Advanced Energy Projects Div.
STRUCTURAL DYNAMIC RESPONSE CHARACTERISTICS OF DARRIEUS VERTICAL AXIS WIND TURBINES
W. N. Sullivan *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 371-384 refs (For primary document see N83-15908 06-44)
(Contract DE-AC04-76DP-00789)
Avail: NTIS HC A23/MF A01

A brief summary of the efforts now underway in the area of the structural dynamics of vertical axis wind turbines is given. The emphasis is on discussing the status of analytical tools, the quantity and quality of existing experimental confirmation data, and the implications structural dynamic issues have on rotor design. R.J.F.

N83-15933# Sandia Labs., Albuquerque, N. Mex. Advanced Energy Projects Div.
AERODYNAMICS AND PERFORMANCE TESTING OF THE VAWT
P. C. Klimas *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 385-396 refs (For primary document see N83-15908 06-44)
(Contract DE-AC04-76DP-00789)
Avail: NTIS HC A23/MF A01

The aerodynamics and testing of vertical axis wind turbines are discussed. Experiments designed to both better understand the aerodynamics of a section operating in an unsteady, curvilinear flowfield and achieve some of the desired changes in section properties are discussed. The common goal of all of these experiments is to increase efficiency an system reliability. R.J.F.

N83-15934# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
TELEVISION INTERFERENCE AND ACOUSTIC EMISSIONS ASSOCIATED WITH THE OPERATION OF THE DARRIEUS VAWT **c32**
N. D. Kelley, R. R. Hemphill, and D. L. Sengupta (Michigan Univ.) *In its* Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 397-410 refs Sponsored in part by the National Research Council of Canada and Hydro-Quebec (For primary document see N83-15908 06-44)
(Contract EG-77-C-01-4042)
Avail: NTIS HC A23/MF A01

Field surveys were conducted to assess the community annoyance potential from electromagnetic interference to television reception (TVI) and acoustic emissions associated with the operation of a Darrieus-type, vertical axis wind turbine (VAWT). The type and extent of interference to nearby television reception was evaluated using a 17 meter VAWT. A series of measurements of observed interference levels were made at a number of sites in the turbine vicinity employing the locally available VHF and UHF television signals as sources. A simple theoretical model was developed for analyzing the TVI produced by the Darrieus turbine. Using this model in conjunction with the field measurements, it was found the Darrieus/VAWT produces the same amount of interference on the lower VHF channels as a horizontal axis turbine with a comparably sized blade scattering area, but less on all other channels. R.J.F.

N83-15935# Aeronautical Research Inst. of Sweden, Stockholm.
SOME INNOVATIVE CONCEPTS IN WIND TURBINES OF THE AXIAL-FLOW, CROSS-FLOW, AND COMBINED (DUAL) FLOW TYPES
Olle Ljungstroem *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 415-432 refs (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

Within the Axial-Flow Turbine (AFT) category, two concepts are described: the Swept-Blade Turbine (SWBT) and the Catenary-Ribbon Blade Turbine (CRBT). Augmentation of turbine mass flow

and power output by increasing the effective sweep area (captured streamtube area) of AFT can be achieved by moving the rotor hub. Some conepts and initial exploratory experiments are described. Among concepts within the Cross-Flow Turbine (CFT) category described are: New applications of the LDB-concept(L-blade and Double Blade) to straight bladed CFT-VAWTS (e g Musgrove turbine, Giromill), Inclined shaft CFT with single and multiple shafts, Spiral Blade Concept, Fluid Ring Bearing VAWT. Further, some Dual-Flow Turbine concepts (DFT) are discussed. These consist of a large primary turbine (AFT or CFT) catching the wind energy and transferring it directly to a much smaller secondary turbine (or Brake-Turbine,BT) with high rpm, mounted on the primary turbine. Among alternatives discussed are primary AFT And CFT in combination with secondary AFT and CFT.
Author

N83-15936# Dayton Univ., Ohio. Research Inst.
AN UPDATE OF THE ELECTROFLUID DYNAMICS WIND DRIVEN GENERATORS
J. E. Minardi and M. O. Lawson *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 433-444 refs (For primary document see N83-15908 06-44)
(Contract EG-77-C-01-4042)
Avail: NTIS HC A23/MF A01

The general objective of the overall research program is to conduct research toward the development of Electrofluid Dynamic (EFD) wind driven generators. In such generators, the wind blows through suitably oriented arrays of electrodes; transports charged particles against an electrical potential gradient; and thereby generates electrical power directly without moving parts. This promises a simpler, less expensive system, free of frontal area and velocity limitations of conventional rotating wind energy systems. For the EFD wind driven generator there are no fundamental reasons to restrict the size; therefore, economies of scale can be realized. A theory for the behavior and performance of EFD wind driven generators was developed. The principle remaining problem is the development of energy economic charged droplet production.
Author

N83-15937# Reading Univ. (England).
RECENT PROGRESS IN THE DEVELOPMENT OF THE MUSGROVE VERTICAL AXIS WIND TURBINE
P. J. Musgrove and I. D. Mays (Sir Robert McAlpine and Sons Ltd.) *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 445-456 refs Sponsored in part by U.K. Science Research Council, U.K. DOE and UKAEA (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

The design of a 25 metre diameter test bed machine is described. It represents a one-quarter scale model of a 100 metre diameter, 4.4. MW rated machine suitable for use in offshore arrays; and the requirement for long life with low maintenance in a marine environment has strongly influenced the design. Economic studies of offshore wind energy systems indicated that the optimum rotor diameter may be well in excess of 100 metres. Vertical axis wind turbines avoid the cyclically varying gravity loads which limit the size of horizontal axis wind turbines, and it is anticipated that subsequent development of the Musgrove wind turbine will extend to units substantially larger than 100 metres diameter.
Author

N83-15938# Washington Univ., St. Louis, Mo.
ATMOSPHERIC TESTING OF A TWO BLADED FURL CONTROLLED WIND TURBINE WITH PASSIVE CYCLIC PITCH VARIATION
Kurt H. Hohenemser and Andrew H. P. Swift *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 457-468 refs (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

Passive cyclic pitch variation, adopted from rotorcraft technology, was achieved by letting the blade pair freely oscillate about a common pivot with which the blades formed a small prelag angle. This simple two-bladed rotor was found to be capable of rapid yaw rates suitable for rotor speed control by yawing, without imposing vibratory hub moments and without producing appreciable out-of-plane blade excursions. During the first phase of testing in 1980 the 7.6 m diameter rotor was automatically furled when 228 rpm at 10 kW rotor power was exceeded. Unfurling was performed manually. During the second phase of testing begun in March, 1981, fully automatic furl control systems were used which limited rotor speed and torque quite accurately to predetermined values. It was found that passive cyclic pitch variation and the associated rapid wind direction following did not degrade and possibly enhanced aerodynamic efficiency.
Author

N83-15939# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
ECONOMICS OF DAWT WIND ENERGY SYSTEMS
K. M. Foreman *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 469-486 refs (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

The results of a (DAWT) preliminary design investigation to assess the economic viability of its electrical energy generation are presented. Unit costs are estimated for three output ratings and for three different construction approaches. A limited production run of 100 to 500 units is considered for factory-built subassemblies and on-site final assembly and erection. Regional production centers are assumed within about 350 km (217 miles) of installation.
Author

N83-15940# AeroVironment, Inc., Pasadena, Calif.
OPTIMIZATION OF THE DYNAMIC INDUCER WIND TURBINE SYSTEM
P. B. S. Lissaman, A. D. Zalay, and B. Hibbs *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 501-512 refs (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

The dynamic inducer, essentially a horizontal axis wind turbine (HAWT) rotor with small vanes at the tips is a promising, advanced technology wind turbine concept. By adding small vanes to the tip of the conventional rotor, significant increases in power can be obtained with the dynamic inducer system. The development of the system is reviewed, including past theoretical and experimental programs. Recent tow tests and wind tunnel tests established the predicted augmentation power. A new optimization program is outlined, based on advanced theory back by extensive wind tunnel testing, aimed at developing an advanced dynamic inducer system for a state-of-the art high performance, two-bladed rotor system. It is estimated that the dynamic inducer rotor is about 20% more cost-effective than a conventional system.
Author

N83-15941# Sydney Univ. (Australia). Dept. of Mechanical Engineering.
EXPERIMENTS WITH A TWIN ROTOR, SINGLE BLADED GYROMILL
J. Blackler, A. J. Barratt, H. Nibbe, and B. W. Roberts *In* Midwest Res. Inst. Fifth Bien. Wind Energy Conf. and Workshop (WW5) 1981 p 513-522 refs Sponsored in part by the Energy Authority of New South Wales (For primary document see N83-15908 06-44)
Avail: NTIS HC A23/MF A01

The concept of a rotary-winged device known as a gyromill is designed. Such a machine is intended to ascend and descend helicopter fashion on its tethers, and yet be capable of generating electricity in a suitable wind. The philosophy of the current design is discussed along with a description of basic construction. The machine consists of twin, eight foot diameter rotors to give an all-up weight of around 70 lb. Preliminary validation of the motor and rotor system was achieved and further experiments are planned.
Author

N83-15942# Sandia Corp., Albuquerque, N. Mex.
SOL-GEL PROTECTIVE COATINGS FOR BLACK CHROME SOLAR SELECTIVE FILMS
R. B. Pettit and C. J. Brinker 1981 18 p refs Presented at SPIE Optical Coatings for Energy Efficiency and Solar Appl. Conf., Los Angeles, Calif., 25 Jan. 1982

(Contract DE-AC04-76DP-00789)
(DE82-004138; SAND-81-1889C; CONF-820107-1) Avail: NTIS HC A02/MF A01

Electrodeposited black chrome solar selective films degrade rapidly when heated to temperatures above 300 C in air. The application of sol-gel protective coatings to the black chrome films was investigated as a possible means to improve the oxidation resistance of black chrome at high temperatures. The sol-gel coating process consists of applying an alcoholic solution containing polymeric glass precursors. After the coating is fired for about one-half hour at a moderate temperature (approximately 450 C), a glass layer is obtained. Because of the wide range of sol-gel processing parameters, initial studies concentrated on determining the effect of the following variables on the thermal stability of sol-gel coated black chrome: sol-gel composition; firing temperature; firing atmosphere; sol-gel coating thickness; and pre-aging of the black chrome films. Of the compositions studied, only SiO2/B2O3 and SiO2/B2O3/Na2O/BaO resulted in improved thermal stability. R.J.F.

N83-15943# Oak Ridge National Lab., Tenn. Engineering Technology Div.
THE ORNL THERMAL ENERGY STORAGE PROGRAM: TECHNICAL SUPPORT
Ralph N. McGill 1981 17 p refs Presented at the Ann. Thermal and Chem. Storage Contractors' Rev. Meeting, Washington, D.C., 14-16 Sep. 1981 2 Vol.
(Contract W-7405-eng-26)
(DE81-030805; CONF-810940-8) Avail: NTIS HC A02/MF A01

The three major elements of the technology development program of the Oak Ridge National Laboratory are discussed. Computer modeling and bench scale experiments of phase change materials, the Thermal Energy Storage Test Facility, and earth thermal storage-assisted heat pump studies are discussed. Each of these program elements are discussed with regard to their objectives and the progress of each during the past year. Also, indications of the direction that each project is taking and the progress anticipated for next year are given. DOE

N83-15944# Oak Ridge National Lab., Tenn. Energy Technology Div.
THE ORNL THERMAL ENERGY STORAGE PROGRAM
James F. Martin 1981 15 p refs Presented at Thermal Energy Storage Ann. Contractors' Rev. Meeting, Washington, D.C., 14-16 Sep. 1981 2 Vol.
(Contract W-7405-eng-26)
(DE81-032001; CONF-810940-9) Avail: NTIS HC A02/MF A01

Development of thermal energy storage technologies and subsystems is discussed. Oak Ridge National Laboratory activities in the areas of building heating and cooling and industrial applications are discussed. Specific subcontract and in-house activities are summarized and the results of research conducted during FY 1981 are given. The major thrust of next year's program is given. DOE

N83-15945# Institute of Gas Technology, Chicago, Ill.
ADVANCED HIGH-TEMPERATURE THERMAL ENERGY STORAGE MEDIA FOR INDUSTRIAL APPLICATIONS
T. D. Clear and R. T. Weibel 1981 7 p refs Presented at the ANN. Contractors' Rev. Meeting on Thermal and Chem. Storage, Tysons Corner, Va., 16 Sep. 1981
(Contract W-7405-eng-26)
(DE82-000161; CONF-810940-16) Avail: NTIS HC A02/MF A01

An advanced thermal energy storage (TES) media concept based on use of carbonate salt/ceramic composite materials is being developed for industrial process and reject heat applications. This paper describes the composite latent/sensible media concept and its potential advantages over state-of-the-art latent heat systems. Media stability requirements, on-going materials development efforts and planned TES performance evaluation tests are discussed. DOE

N83-15946# New Mexico Univ., Albuquerque. Dept. of Mechanical Engineering.
PERFORMANCE OF LABYRINTH-STRATIFIED WATER-STORAGE SYSTEM FOR HEATING AND COOLING
M. W. Wildin 1981 9 p refs Presented at the Ann. Contractors' Rev. Meeting on Thermal and Chem. Storage, Tysons Corner, Va., 16 Sep. 1981
(Contract W-7405-eng-26)
(DE82-000107; CONF-810940-11) Avail: NTIS HC A02/MF A01

The performance of a set of thermal storage tanks using water as the storage medium and the labyrinth technique to help maintain separation of warmer and cooler water was monitored during most of the 1980-81 heating season and is being monitored during the 1981 cooling season. The results indicate the effectiveness of this technique for leveling of the power drawn from a utility. They also indicate the potential for energy conservation via heat recovery during the heating season. The scheme was incorporated in thermal storage tanks constructed for the Mechanical Engineering Building at the University of New Mexico. DOE

N83-15947# North Carolina State Univ., Raleigh. Dept. of Materials Science.
EVALUATION OF OLIVINE CERAMIC REFRACTORIES FOR THERMAL-ENERGY-STORAGE APPLICATION
H. Palmour, B. M. Gay, and R. L. Cochran 1981 7 p Presented at the Ann. Contractors' Rev. Meeting on Thermal and Chem. Storage, Tysons Corner, Va., 16 Sep. 1981
(Contract W-7405-eng-26)
(DE82-000108; CONF-810940-27) Avail: NTIS HC A02/MF A01

The degree of improvement in thermal and mechanical performance that can be obtained with an olivine thermal storage brick made of domestic materials using advanced processing techniques compared with state-of-the-art as represented by commercial European bricks is discussed. The goals and results of the study are given. DOE

N83-15948# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
THERMAL ENERGY STORAGE TESTING FACILITIES
Robert J. Schoenhals, S. H. Anderson, L. W. Stevens, W. R. Laster, and M. R. Elter 1981 7 p refs Presented at the Ann. Contractors Rev. Meeting on Thermal and Chem. Storage, Tysons Corner, Va., 14-16 Sep. 1981
(Contract W-7405-eng-26)
(DE82-000110; CONF-810940-24) Avail: NTIS HC A02/MF A01

Development of a prototype testing facility for performance evaluation of electrically heated thermal energy storage units is discussed. Laboratory apparatus and test procedures are being evaluated by means of measurements and analysis. Testing procedures were improved, and test results were acquired for commercially available units. A 30 kW central unit and several smaller individual room-size units were tested. DOE

N83-15949# Argonne National Lab., Ill.
FIELD EVALUATION AND ASSESSMENT OF THERMAL ENERGY STORAGE FOR RESIDENTIAL SPACE HEATING
H. N. Hersh 1981 6 p refs Presented at Ann. Contractors' Rev. Meeting on Thermal and Chem. Storage, Washington, D.C., 14-16 Sep. 1981
(Contract W-7405-eng-26)
(DE82-000164; CONF-810940-23) Avail: NTIS HC A02/MF A01

Based on New England field test data covering two heating seasons, thermal energy storage (TES) is technically viable and acceptable to its users. An analysis is underway comparing the efficiency of electricity utilization of direct and storage heating systems. Economics (higher cost of TES systems and changes in rate structures) represents the largest impediment to sufficient market penetration. DOE

N83-15950# Oak Ridge National Lab., Tenn.
MATHEMATICAL MODELING OF TES SUBSYSTEMS
A. D. Solomon 1981 5 p refs Presented at Ann. Contractors' Rev. Meeting on Thermal and Chem. Storage, Washington, D.C.,

14-16 Sep. 1981
(Contract W-7405-eng-26)
(DE82-000168; CONF-810940-21) Avail: NTIS HC A02/MF A01

Results of research into phase change models for latent heat storage are described. These are of both a simulation and analytical nature and continue the work of past years in this effort. A simulation code for the cooling an dehumidification of an air stream due to phase change material cylinders is discussed. The development of a bogus specific heat for phase change calculations is discussed. DOE

N83-15951# Sandia Labs., Albuquerque, N. Mex.
OIL-SHALE PROGRAM Quarterly Report, Apr. - Jun. 1981
Benjamin E. Bader, ed. Oct. 1981 54 p refs
(Contract DE-AC04-76DP-00789)
(DE82-900588; SAND-81-1973; QR-22) Avail: NTIS HC A04/MF A01

The principal activities of the Sandia National Laboratories in the Department of Energy Oil shale program during the period April 1 to June 30, 1981 are discussed. Currently, Sandia's activities are focused upon: the development and use of analytical and experimental modeling techniques to describe and predict the retort properties and retorting process parameters that are important to the preparation, operation, and stability of in situ retorts, and the development, deployment, and field use of instrumentation, data acquisition, and process monitoring systems to characterize and evaluate in site up shale oil recovery operations. In-house activities and field activities (at the Geokinetics Oil Shale Project and the Occidental Oil Shale Project) are described under the headings: bed preparation, bed characterization, retorting process, and structural stability. DOE

N83-15952# California Univ., Livermore. Lawrence Livermore Lab.
REACTION KINETICS AND DIAGNOSTICS FOR OIL-SHALE RETORTING
A. K. Burnham 19 Oct. 1981 32 p refs Presented at 2nd IGT Symp. on Synthetic Fuels from Oil Shale, Nashville, 26 Oct. 1981
(Contract W-7405-eng-48)
(DE82-001598; UCRL-86794; CONF-811054-1) Avail: NTIS HC A03/MF A01

The advances in pyrolysis chemistry and kinetics and the resulting diagnostic methods based on effluent products for determining retort performance were reviewed. Kerogen pyrolysis kinetics and stoichiometry were generalized by further measurements on a larger number of samples. Analysis by capillary colunn gas chromatography of shale oil samples produced under a variety of field and laboratory conditions resulted in a method for determining the oil yield from a combustion retort. Measurement of sulfur products under a variety of conditions led to an understanding sulfur reactions both those of processing and environmental importance. Equations for estimating the heat of combustion of spent shale were developed by understanding oil shale composition and reactions. DOE

N83-15953# Sandia Labs., Albuquerque, N. Mex.
LIFETIME AND EFFECTIVE SURFACE RECOMBINATION VELOCITY MEASUREMENTS IN HIGH-EFFICIENCY Si SOLAR CELLS
B. H. Rose 1981 4 p refs Presented at the Intern. Electron Devices Meeting, Washington, D. C., 7 Dec 1981
(Contract DE-AC04-76DP-00789)
(DE81-030361; SAND-81-2090C; CONF-811207-1) Avail: NTIS HC A02/MF A01

A conventional analysis method, based on minority carrier diffusion in a solar cell base, is used to obtain bulk lifetime (tau) and effective back-surface recombination velocity (S) from measurements of asymptotic decay times of short-circuit current and open circuit voltage. Since the decay times depend individually on both S and tau, it is necessary to use both current and voltage data for unique results. Experimental measurements of current and voltage transients are presented from variable base resistivity cells, irradiated cells and cells with intentionally damaged back surface field regions. These cells exhibit lifetimes from one to several hundred microseconds and recombination velocities from 100 to 5000 cm/sec. All features of the data are accounted for by the analysis. DOE

N83-15954# Sandia Labs., Albuquerque, N. Mex.
VERTICAL-AXIS WIND-TURBINE PROGRAM
R. H. Braasch 1981 28 p refs Presented at the 5th Bien. Wind Energy Conf. and Workshop, Washington, D. C., 5 Oct. 1981
(Contract DE-AC04-76DP-00789)
(DE82-003531; SAND-81-1804C; CONF-811043-12) Avail: NTIS HC A03/MF A01

The vertical axis wind turbine program is discussed. Progress in aerodynamics research, structural dynamics research, and machine development is reviewed. Laminar flow, boundary layer control, cambered blades, and costs are also discussed. DOE

N83-15955# Oak Ridge National Lab., Tenn.
ALTERNATIVE MEANS OF COPING WITH NATIONAL ENERGY EMERGENCIES
J. H. Sorensen 1981 9 p refs Presented at the 3rd Intern. Conf. on Energy Use Management, West Berlin, F. R., Germany, 26 Oct. 1981
(Contract W-7405-eng-26)
(DE82-002812; CONF-811006-8) Avail: NTIS HC A02/MF A01

A comprehensive management framework is suggested for coping with largescale energy shortages. In doing so, events that may trigger a shortage are overviewed. A systems model of a shortage is discussed. Alternative management strategies are suggested and concepts of evaluating the strategies are briefly reviewed. The conclusion is made that national policies should emphasize a broad-based approach to coping with shortages with long term goals of preventing the events that cause emergencies. DOE

N83-15956# Oak Ridge National Lab., Tenn.
ONCE-THROUGH HEAT TRANSPORT AND SEASONAL STORAGE FOR CITY OF BELLINGHAM
I. Oliker (Burns and Roe, Inc., Oradell, N. J.) and M. Olszewski 1981 12 p refs Presented at Intern. Energy Storage Conf., Seattle, Wash., 19 Oct. 1981
(Contract W-7405-eng-26)
(DE82-001501; CONF-811066-1) Avail: NTIS HC A02/MF A01

A conceptual design of a once-through district heating system utilizing industrial waste heat was developed for the city of Bellingham, Washington. Two once-through designs are evaluated. Case 1 is based on an assumption that 67 MWt can be obtained from an aluminum plant and supplementary heat sources and does not require a seasonal thermal storage facility. Case 2 is based on the extraction of 45 MWt from the aluminum plant and requires a seasonal thermal storage facility. These once-through systems were compared with the closed district heating system design which uses a two-pipe heat transport arrangement that returns the used water to the aluminum plant. In 1980 dollars, once through system case 1 would provide an economic advantage of about $10.7 million over the closed system. Case 2 would incur a disadvantage of about $9.1 million in comparison with the closed system, largely because of the high cost of seasonal thermal storage tanks. DOE

N83-15957# Energy Utilization Systems, Inc., Pittsburgh, Pa.
SURVEY OF UTILITY LOAD MANAGEMENT PROJECTS: THIRD REVISED REPORT
Oct. 1981 342 p refs
(Contract W-7405-eng-26)
(DE82-000888; ORNL/Sub-80-13644-1) Avail: NTIS HC A15/MF A01

The 86 utility sponsored thermal energy storage (TES) projects and 158 communiation and load control (C&CL) projects are described. These projects are grouped into two mainsections (TES and C&CL) and into several subsections, according to the type of TES or C&CL system or device utilized. Each subsection contains:

a technical description of the particular system or device, a discussion of installed costs, if such information is available, and a listing of the manufacturer(s) of the hardware. A comprehensive table of all utility projects that involve the use of this hardware is presented. Additional information on selected projects in expanded summary forms is presented. These projects were selected based on their uniqueness, scope, maturity, results or because they are representative of utility projects utilizing similar hardware. DOE

N83-15958# Los Alamos Scientific Lab., N. Mex.
USE OF OXIDE DECOMPOSITIONS IN ADVANCED THERMOCHEMICAL HYDROGEN CYCLES FOR SOLAR HEAT SOURCES. EXPERIMENTAL RESULTS ON THE LOW-TEMPERATURE REACTIONS FOR THE TRICOBALT TETRAOXIDE-COBALT MONOXIDE PAIR
Wesley M. Jones and Melvin G. Bowman 1982 9 p refs Presented at the World Hydrogen Energy Conf., Pasadena, Calif., 13-17 Jun. 1982
(Contract W-7405-eng-36)
(DE82-002390; LA-UR-81-2927; CONF-820605-3) Avail: NTIS HC A02/MF A01

The concept of utilizing oxide decompositions in advanced thermochemical hydrogen cycles for solar heat sources is introduced. It has particular interest in allowing direct transmission of energy to the process through an air window. A cycle for the Co3O4-CoO pair would be, schematically: (1) Co3O4 = 3CoO + 1/2 O2; (2) I2(s,1) + Mg(OH)2 + 3CoO = MgI2(aq) + Co3O4 + H2O(1); (3)H20 + MgI2(aq) = MgO + 2HI; (4)2 HI = H2 + I2; (5) MgO + H2O = Mg(OH)2. Reaction (2) should give a high concentration of MgI2 that would be favorable for (3). The solutions would also contain iodine dissolved as polyiodide, partly offsetting this advantage. Preliminary results are indicated. DOE

N83-15959# Atomic Energy Research Establishment, Harwell (England).
CORROSION TESTS IN THE MARCHWOOD GEOTHERMAL BOREHOLE
P. F. Lawrence Mar. 1982 23 p
(AERE-G-2225) Avail: NTIS HC A02/MF A01

Corrosion tests in the high salinity brine produced during a production test at the Marchwood borehole. These tests were intended to obtain preliminary information on the corrosion of a range of metals and alloys most likely to be used for downhole service, heat exchangers and associated equipment, if hot water from this aquifer is used to provide a long-term energy source. Specimens of appropriate candidate materials were exposed to flowing brine in the surface pipework and also downhole at a depth of 663 m. The brine was pumped to the surface by a multi-stage electric submersible pump. The downhole specimens, which were installed with the pump, were exposed for a period of 83 days. The surface specimens were exposed during the well production test for 33.3 days. The product brine was around three times sea water concentration, at a temperature of 72 C and pH 6.2. Author

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N83-15960# California Univ., Livermore. Lawrence Livermore Lab.
IDEAS FOR IMPLEMENTING AIR-QUALITY STUDIES IN THE WESTERN ROCKY MOUNTAIN REGION
Marvin H. Dickerson Jul. 1982 16 p refs Presented at the 2nd Conf. on Oil Shale: The Environ. Challenges, Vail, Colo., 10-13 Aug. 1981
(Contract W-7405-eng-48)
(DE82-000063; UCRL-86467; CONF-810838-2) Avail: NTIS HC A02/MF A01

To assess the impact of energy development in the western region of the Rocky Mountains, several space scales should be considered. The overall multistate region should be investigated from the view of baseline air quality and meteorology measurements. Results from a well designed and implemented baseline program would, in the future, be a valuable asset to answer critical questions about the air quality impact of energy development in this region. Modeling for an area this size (about 1000 km on a side) could wait until more reliable models are developed to address transport and diffusion on this scale in complex terrain. Also, studies on this scale require considerable resources and could be best handled by joint multiagency participation. For regions of approximately 200 km on a side, considerable research is presently underway by Federal agencies, universities, and private industry concerning atmospheric studies in complex terrain. DOE

N83-15961# Tetra Tech, Inc., Melville, N.Y.
ASSESSMENT METHODOLOGY FOR NEW COOLING LAKES. VOLUME 3: LIMNOLOGICAL AND FISHERIES DATA AND BIBLIOGRAPHY Final Report
Oct. 1981 354 p refs Sponsored in part by DOE and Electric Power Research Inst.
(DE82-900967; EPRI-EA-2059-Vol-3) Avail: NTIS HC A16/MF A01

Limnological and fisheries data were compiled for potential users in the utility industry. Published papers, reports, other written information, computer files, and direct contracts were used to compile a matrix of information. Data and the bibliographic sources of the power plant and geographical, limnological, and fisheries information for 181 lakes and reservoirs, of which 134 were used for cooling purposes are given. Data for 65 lakes were completed with respect to the limnology and fisheries parameters so that complete statistical analysis could be performed. Of these 65 lakes, 42 are used for cooling. Tables contain data arranged by utility, power plant, limnology, water quality, morphoedaphic, and fishery categories. The data in the tables are keyed to a lake code. The references for the data shown are keyed to a numerical listing of the bibliography. Author, state, lake, and subject indexes facilitate searching for bibliographic information. R.J.F.

N83-15962# California Univ., Livermore. Lawrence Livermore Lab.
WORKSHOP ON ENVIRONMENTAL RESEARCH FOR ACTINIDE ELEMENTS
Robert L. Watters, ed. Sep. 1981 27 p Conf. held in Livermore, Calif., 17-19 Mar. 1981
(Contract W-7405-eng-48)
(DE82-001877; CONF-810397) Avail: NTIS HC A03/MF A01

Advances in the environmental chemistry of plutonium and the feasibility and worth of developing environmental transport models which might serve as predictive tools for long term behavior and as guides for future research needs are discussed. Two plutonium models of the soil plant pathway were presented for critique and as examples of possible approaches. Reports of the following four panels are presented: model development; marine; terrestrial and freshwater/groundwater. DOE

N83-15963# Oak Ridge National Lab., Tenn.
INTEGRATED AIR SAMPLING FOR RADON DAUGHTERS IN MINES USING THE CRYOGENIC AIR-SAMPLING METHOD
P. T. Perdue and F. F. Haywood 1981 12 p refs Presented at the Intern. Conf. on Radiation Hazards in Mining: Control, Meas., and Med. Aspects, Golden, Colo., 4 Oct. 1981
(Contract W-7405-eng-26)
(DE82-002913; CONF-8110111-1) Avail: NTIS HC A02/MF A01

The parameters governing air sampling in the environment were investigated. The cryogenic sampling of air can be successfully accomplished under a wide variety of atmospheric conditions with proper design of sampling vessel and orifice. Although the sampling rate decreases with time due to ice formation in the sampling vessel, sampling can be done over a period of 16 hours or more at relative humidities up to 80%. The concentration of all three isotopes of radon in air can be measured by spectroscopy of gamma rays emitted by the various daughters. In a similar

manner, the concentration of Kr85 and other gamma emitting fission gases can be determined with the cryogenic technique. The sampling technique requires no external power source because the energy required for sampling is provided by the slow evaporation of liquid nitrogen. DOE

N83-15964# California Univ., Los Angeles. Lab. of Biomedical and Environmental Sciences.
ENVIRONMENTAL EFFECTS OF SOLAR-THERMAL POWER SYSTEMS. EFFECT OF SEVERAL THERMAL TRANSFER/STORAGE FLUIDS ON BARLEY SEED GERMINATION AND SEEDLING GROWTH
H. Nishita and R. M. Haug Sep. 1981 48 p refs
(Contract DE-AC03-76SF-00012)
(DE82-002526; UCLA-12-1315) Avail: NTIS HC A04/MF A01

Plant toxicity threshold level of used thermal transfer/storage materials (Therminol 66, Caloria HT43, Syltherm 800, and Partherm 430) in four different soils were determined by using a modified Neubauer technique. The plant toxicity threshold level of toluene, which is a leading candidate for engine working fluid, was also determined. In three of the soils (Aiken c.l., Yolo c.l., and Egbert muck), the material tolerated in the least amount was Syltherm 800 and that tolerated in the greatest amount was Caloria HT43 from the Coolidge and Willard projects. In the fourth soil (Soil JF79), the material tolerated in the least and in the greatest amount was Partherm 430 and toluene, respectively. Some chemical analyses of thermal transfer/storage materials were also done. Of the elemental contaminants (Al, Fe, Mn, Co, Cr, Zn, Cu, Cd, Pb, and Ni) determined only a few occurred in concentrations greater than 10 mg/1 of oil or 10 micro g/g of salt material. DOE

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N83-15965# Geological Survey, Washington, D. C.
THE GEOTHERMAL RESEARCH PROGRAM OF THE US GEOLOGICAL SURVEY
1982 18 p refs
(USGS-Circ-862) Avail: NTIS HC A02/MF A01

The history of the geothermal research program of the U.S. geological survey is presented. N.W.

N83-15966# Geological Survey, Washington, D. C.
EARTHQUAKES IN THE UNITED STATES, APRIL - JUNE 1981
C. W. Stover, J. H. Minsch, P. K. Dunbar, and B. G. Reagor 1982 37 p refs
(Circ-871-B) Avail: NTIS HC A03/MF A01

A tabular listing of earthquakes in chronological order by State, consisting of the following basic information is given: date, origin time, hypocenter, magnitude, maximum intensity, and computational source of the hypocenter. Intensity information, consisting of four maps, three photographs, and a table is given. Information on events that were felt but were not listed because there was not enough instrumental data to obtain a solution is given. R.J.F.

N83-15967*# TRW Systems Group, Redondo Beach, Calif. Space and Technology Group.
ONGOING DATA REDUCTION, THEORETICAL STUDIES, AND SUPPORTING RESEARCH IN MAGNETOSPHERIC PHYSICS Final Report, Oct. 1979 - Sep. 1982
F. L. Scarf and E. W. Greenstadt 24 Sep. 1982 95 p refs
(Contract NASw-3087)
(NASA-CR-169707; NAS 1.26:169707; TRW-31219-6026-UT-00) Avail: NTIS HC A05/MF A01 CSCL 04A

The investigators published a very large number of space science research papers, and in almost all cases these papers involved correlative multi-spacecraft studies. A tabulation of these research papers is provided. Quarterly progress reports for the second contractual period are included. Author

N83-15968*# California Inst. of Tech., Pasadena. Seismological Lab.
ANALYSIS OF SEISMIC BODY WAVES EXCITED BY THE MOUNT SAINT HELENS ERUPTION OF MAY 18, 1980
Hiroo Kanamori, Jeffrey W. Given, and Thorne Lay [1982] 40 p refs
(Grant NsG-7610)
(NASA-CR-169741; NAS 1.26:169741) Avail: NTIS HC A03/MF A01 CSCL 08K

Seismic body waves which were excited by eruption of Mt. St. Helens, and recorded by the Global Digital Seismographic Network (GDSN) stations are analyzed to determine the nature and the time sequence of the events associated with the eruption. The polarity of teleseismic P waves (period 20 sec) is identical at six stations which are distributed over a wide azimuthal range. This observation, together with a very small S to P amplitude ratio (at 20 sec), suggests that the source is a nearly vertical single force that represents the counter force of the eruption. The time history of the vertical force suggests two distinct groups of events, about two minutes apart, each consisting of several subevents with a duration of about 25 sec. The magnitude of the force is approximately 2.6 to the 17th power dyne. this vertical force is in contrast with the long period (approximately 150 sec) southward horizontal single force which was determined by a previous study and interpreted to be due to the massive landslide. S.L.

N83-15969# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COMPARISON OF STORM-TIME CHANGES OF GEOMAGNETIC FIELD AT GROUND AT MAGSAT ALTITUDES Final Report
Rajaram Purushottam Kane and Nalin Babulal Trivedi Jan. 1983 43 p refs
(INPE-2615-RPE/424) Avail: NTIS HC A03/MF A01

The values of H, X, Y, Z at MAGSAT altitude were first expressed as residuals delta H, delta X, delta Y, delta Z after subtracting the model values HMD, XMD, YMD, ZMD. The storm time variations of delta H showed that delta H (dusk) was larger (negative) than delta H (dawn) and occurred earlier, indicating a sort of hysteresis effect. Effects at MAGSAT altitudes were roughly the same (10% accuracy) as at ground, indicating that these effects were mostly of magnetospheric origin. The delta Y component also showed large storm time changes. The latitudinal distribution of storm time delta H showed north-south asymmetries varying in nature as the storm progressed. It seems that the central plane of the storm time magnetospheric ring current undergoes latitudinal meanderings during the course of the storm. S.L.

N83-15970# Air Force Geophysics Lab., Hanscom AFB, Mass.
ELECTRON AND PROTON SPECTROMETRY IN THE AIR FORCE GEOPHYSICS LABORATORY AURORAL E PROGRAM. 1: EXPERIMENT OVERVIEW AND PRELIMINARY AURORAL ELECTRON DATA Interim Report
W. J. McMahon, L. Heroux, and R. H. Salter 9 Apr. 1982 25 p refs
(AF Proj. 6690)
(AD-A120861; AFGL-TR-82-0121; AFGL-ERP-776) Avail: NTIS HC A02/MF A01 CSCL 07/4

The design of spectrometers to determine electron and proton spectra over energy ranges between 2 eV and 60 keV, and their application in a dual rocket experiment to measure these particle fluxes in a continuous aurora, are discussed briefly. Details of the overall experiment, including relevant flight parameters, are given, and preliminary results of electron measurements are presented. Author (GRA)

N83-15971# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF THE DATE RATE EMANATING FROM GAMMA RADIATION OF A GAS JET PROPAGATING THROUGH THE SURFACE LAYER OF THE ATMOSPHERE

O. V. Zakharov, V. V. Kovalenko, and V. M. Kolobashkin 22 Sep. 1982 8 p refs Transl. into ENGLISH from Vop. Dozim. i Zashch. Izluch. (USSR), no. 12, 1971 p 94-97
(AD-A120731; FTD-ID(RS)T-1310-82) Avail: NTIS HC A02/MF A01 CSCL 04/1

The problem of calculating the dose rate on the Earth's surface which emanates from a gas jet is examined. N.W.

N83-15972# Air Force Geophysics Lab., Hanscom AFB, Mass.
A GLOBAL THERMOSPHERIC DENSITY MODEL BASED ON SATELLITE ACCELEROMETER DATA Environmental Research Papers
Frank A. Marcos, Dorothy F. Gillette, and Edward C. Robinson 26 Jan. 1982 41 p refs
(AF Proj. 6690)
(AD-A119861; AFGL-TR-82-0025; AFGL-ERP-766) Avail: NTIS HC A03/MF A01 CSCL 04/1

Measurements from the accelerometer experiments on four low-altitude satellites (S3-1 and Atmospheric Explorer-C, -D,and -E) have been combined toproduce an empirical model of the neutral mass density from 140 to 240 km. Data from over 8000 orbits are analyzed using the least-squares method of multiple linear regression. The resulting model gives density as a function of solar flux (for fluz values 60 to 130 units),geomagnetic activity, day of year, local time, latitude and altitude. It provides a more accurate fit to the measured data than other available atmospheric models. Three commonly used models are evaluated by comparison of their predicted density variations with those ofthis empirical-model. GRA

N83-15973# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
UPPER ATMOSPHERE CHEMICAL RELEASE AND SMOKE TRAIL TRIANGULATION, 1978-1981 Final Report, Sep. 1978 - Oct. 1981
Howard D. Edwards Hanscom AFB, Mass. AFGL Oct. 1981 8 p
(Contract F19628-78-C-0077; AF Proj. 6687)
(AD-A119925; GIT-AER-E-16-665; AFGL-TR-81-0334) Avail: NTIS HC A02/MF A01 CSCL 04/2

The objective of the first three field trips was to determine experimentally the magnitude and direction of stratospheric winds and shears, and to mark persistent layers of turbulence as a function of geographic latitude. The experiment conducted at Wallops Island, Virginia provided data corresponding to mid-latitudes. The trips to Ft. Churchill, Canada and Lima, Peru provided similar data corresponding to Arctic and Tropical Latitudes respectively. The objective of the trip to Fairbanks, Alaska in February, 1981 was to launch a cooperative AFGL Space Physics and Aeronomy division rocket, satellite, aircraft and ground-based experiment which would gather the data necessary to test the concepts of making quantitative electron density assessments from optical measurements. GRA

N83-15974# Photometrics, Inc., Woburn, Mass.
FURTHER EVALUATIONS OF INFRARED SIMULATION DATA
Irving L. Kofsky, Christian A. Trowbridge, Dennis P. Villanucci, and Malcolm T. Chamberlain 30 Nov. 1981 128 p refs
(Contract DNA001-81-C-0003)
(AD-A119946; AD-E301039; PHM-07-81; DNA-TR-81-41) Avail: NTIS HC A07/MF A01 CSCL 04/1

Infrared-optical atmospheric nuclear backgrounds simulation data from DNA/AFGL rockets EXCEDE: Spectral and PRECEDE (excitation of air by 3 keV electron beams) and NKC-135A aircraft (aurora and airglow radiations) are evaluated and interpreted. The output of 2.8 - 3.1 micron radiation from the auroral ionosphere, measured with a radiometer having footprint less than 1 km square, is correlated with particle energy input to within less than or approx. 3 sec, and the yield varies between 0.6% and 1.3%. No statistically significant correlation was found between this SWIR emission efficiency or delay and a series of auroral (and measurement) parameters, which included the fractional solar illumination of the radiating air volumes. The distributions of visible radiance from EXCEDE are found to differ from predictions of accepted models of electron transport and atmospheric excitation, both individual photographic frames and as a function of charge-ejection altitude; principally, there is an excess of radiation from within a few rocket diameters, and the mean brightness changes much more slowly than the ambient air density 6300 angstrom units glow that resulted when ionosphere-recombining molecules were exhausted by HEAO-C's launch rocket (Eastern Test Range, 20 Sep 79) were derived from calibrated video images; its lateral growth rates indicate that the widespread F-region after-glow results principally from reactions of H log. GRA

N83-15975# Lowell Univ., Mass. Center for Atmospheric Research.
AUTOMATED IONOGRAM PROCESSING SHOWS SEASONAL VARIATIONS IN THE AURORA IONOSPHERE
Bodo W. Reinisch, Jane Tang, William N. Hall, and Jurgen Buchau Hanscom AFB, Mass. AFGL Mar. 1982 17 p refs Prepared in cooperation with AFGL, Hanscom AFB
(Contract F19628-80-C-0064; AF Proj. 4643)
(AD-A119911; ULRF-420/CAR; SR-2; AFGL-TR-82-0122) Avail: NTIS HC A02/MF A01 CSCL 04/1

Automatic processing of digital ionograms from Goose Bay, Labrador (65 deg corrected geomagnetic latitude), permits fast evaluation of the diurnal and seasonal variations in the ionosphere. Ionogram data from 1980 are processed and displayed in ways that show the seasonal variations in foF2 and hminF. The effects of the mid-latitude trough that moves over the Goose Bay Station in the late evening are discussed. GRA

N83-15976# Scripps Institution of Oceanography, La Jolla, Calif. Visibility Lab.
AN ANALYSIS OF NATURAL VARIATIONS IN EUROPEAN SKY AND TERRAIN RADIANCE MEASUREMENTS Interim Lab.
Richard W. Johnson and Wayne S. Hering Hanscom AFB, Mass. AFGL Sep. 1981 58 p refs
(Contract F19628-78-C-0200; AF Proj. 7670)
(AD-A120487; SIO-82-6; SR-20; AFGL-TR-81-0317) Avail: NTIS HC A04/MF A01 CSCL 04/1

A data set, first described in AFGL-TR-81-0275, Johnson (1981), which contains nearly 500 arrays representing measurements of sky and terrain radiance values, is reviewed and further illustrated with respect to naturally occurring radiance variations. The measurements were made using radiometer systems mounted on a C-130 aircraft during a series of European flights associated with the NATO Program OPAQUE, Fenn (1978) and Johnson et al. (1979). Radiance measurements throughout the 4 pi field surrounding the aircraft during seventeen separate flight episodes are presented and discussed with respect to their variability as a function of altitude, look angle, cloud cover and spectral band. The measurements were made in spectral bands having mean wavelengths of 478, 577, 664 and 765 nm, and under meteorological conditions ranging from fully overcast to clear and cloudfree. With appropriate caveats, examples of typical overcast, broken cloud and clear day radiance distributions are illustrated. Whereas these data illustrate substantial variations in the radiance distribution from day to day, there are determinable patterns that may provide boundary conditions for a very generalized attempt of classification. Thus, as were the data displayed in the earlier companion report, Johnson (1981), these data are appropriate for use in the development of operationally useful predictive models as illustrated in Hering (1981). GRA

N83-15977# Atmospheric and Environmental Research, Inc., Cambridge, Mass.
A RESEARCH PROGRAM FOR ATMOSPHERIC CHEMISTRY, RADIATION AND DYNAMICS Final Report, Dec. 1980 - Jun. 1982
N. D. Sze, M. K. W. Ko, M. Livshits, W. C. Wang, and P. B. Ryan Hanscom AFB, Mass. AFGL Jul. 1982 166 p refs Sponsored in part by Chemical Manufacturers Assoc.
(Contract F19628-81-C-0016; AF Proj. 6687)
(AD-A120407; AFGL-TR-82-0207) Avail: NTIS HC A08/MF A01

CSCL 07/2

This report presents major accomplishments and significant findings of atmospheric research performed under AFGL contract F19628-81-C-0016 for the period December 1980 to June 1982. The following topics are discussed: review of recent developments in stratospheric chemistry; modeling results on ozone perturbation studies; results of the zonal-mean model calculations covering calculated species concentrations and atmospheric lifetimes; role of meteoric metal in atmospheric chemistry. Author (GRA)

N83-15978# Sandia Labs., Albuquerque, N. Mex.
OBSERVATIONS AND ANALYTIC CALCULATIONS OF STRATA MOVEMENT ABOVE IDEALIZED MINE STRUCTURES
H. J. Sutherland, K. W. Schuler, and S. E. Benzley (Brigham Young Univ.) 1981 13 p refs Presented at the 7th Underground Coal Conversion Symp., Fallen Leaf Lake, Calif., 8-11 Sep. 1981
(Contract DE-AC04-76DP-00789)
(DE82-000257; SAND-81-0927C; CONF-810923-11) Avail: NTIS HC A02/MF A01

Centrifuge experiments and numerical models were used to characterize the strata movement above a mine drift that is located below many relatively thin layers of strata. The centrifuge simulations show progressive failure of the strata, the formation of a corbeled arch over the mine drift and ultimately the formation of a subsidence trough. The quantitative data from these experiments are analyzed using finite element numerical techniques. DOE

N83-15979# Los Alamos Scientific Lab., N. Mex.
EARTHQUAKE CATALOG FOR NORTHERN NEW MEXICO Progress Report, Apr. - Jun. 1981
D. J. Cash, K. H. Olsen, N. J. McFarland, and J. J. Wolff Oct. 1981 12 p refs
(Contract W-7405-eng-36)
(DE82-004185; LA-9036-PR) Avail: NTIS HC A02/MF A01

A summary of the earthquakes located in northern New Mexico by seismic arrays. Data are presented in the form of tables and epicenter maps, with a brief explanatory text. DOE

N83-15980# California Univ., Livermore. Lawrence Livermore Lab.
RESISTIVITY MEASUREMENTS AS A INDICATION OF CLAY AND/OR ZEOLITE CONTENT IN TERTIARY VOLCANIC TUFFS AND QUATERNARY ALLUVIUM AT THE NEVADA TEST SITE
Gayle A. Pawloski 21 Oct. 1981 20 p ref Presented at the Monterey Containment Symp., Calif., 26 Aug. 1981
(Contract W-7405-eng-48)
(DE82-002019; UCRL-86805; CONF-810884-1) Avail: NTIS HC A02/MF A01

In situ clay content as an important parameter in the containment evaluation of underground nuclear ests is discussed. The laboratory measured clay content of the sample is assumed to be representative of the in situ clay content. A three phase study is being done to determine if resistivity values are indicative of in situ clay and/or zeolite content of Nevada test site rocks. Phase I was a statistical study to determine the correlation of resistivity values and clay content by testing the distributions of clay contents of the samples against resistivity values. The resuls study indicate that, over the range of montmorillonite contents studied (0 to 50%), there is no correlation between resistivity measurements and the clay content of samples. DOE

N83-15981# California Univ., Livermore. Lawrence Livermore Lab.
NTS SEISMIC-REFLECTION DATA AND THE PROBLEMS THEREOF
Norman R. Burkhard 21 Oct. 1981 6 p refs Presented at the Monterey Containment Symp., Monterey, Calif., 26-28 Aug. 1981
(Contract W-7405-eng-48)
(DE82-002001; UCRL-86803; CONF-810884-2) Avail: NTIS HC A02/MF A01

Seismic reflection data are difficult to process and interpret. The problems observed in the data are lack of high frequencies, lack of lateral coherency, and masking of the large acoustic impedance contrast at the tuff/Paleozoic interface. These problems are probably the result of the geology of the alluvial and volcanic sections. Seismic processing techniques to help overcome these problems are discussed. DOE

N83-15697# Kuibyshev Civil Engineering Inst., Moscow (USSR). Lab. for Engineering Cryopedology in Power-Plant Construction.
HEAVING DEFORMATION AND THERMAL CREEP OF FROZEN, ICE-SATURATED, COARSE-GRAINED SOILS
N. A. Tsytovich, Y. A. Kronik, and A. N. Gavrilov *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 43-52 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15698# Nottingham Univ. (England).
STRENGTH AND CREEP TESTING OF FROZEN SOILS
A. R. Gardner, R. H. Jones, and J. S. Harris (Foraky Ltd., Nottingham, England) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 53-60 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15699# Alaska Univ., Fairbanks. School of Engineering.
PERMAFROST CREEP MEASUREMENTS IN THE CRREL TUNNEL
Nils I. Johansen and John W. Ryer (Dresser-Atlas Oil Field Service Group) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 61-64 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15700# Academia Sinica, Lanzhou (China). Inst. of Glaciology and Cryopedology.
ELASTIC AND COMPRESSIVE DEFORMATION OF FROZEN SOILS
Zhu Yuanlin, Zhang Jiayi, and Wu Ziwang *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 65-77 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15701# Karlsruhe Univ. (West Germany). Inst. for Soil Mechanics and Rock Mechanics.
LONG-TERM CREEP OF FROZEN SOIL IN UNIAXIAL AND TRIAXIAL TESTS
Wolfgang Orth and Helmut Meissner *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 81-87 refs Sponsored by Deilmann Haniel G.m.b.H. (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15702# Michigan Technological Univ., Houghton.
COMPARATIVE RESPONSE OF SOILS TO FREEZE-THAW AND REPEATED LOADING
Bernard D. Alkire and James A. Morrison *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 89-96 refs Sponsored by NSF (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15703# McGill Univ., Montreal (Quebec). Dept. of Civil Engineering.
SHORT-TERM CYCLIC FREEZE-THAW EFFECT ON STRENGTH PROPERTIES OF A SENSITIVE CLAY
R. N. Yong, P. Boonsinsuk, and D. Murphy *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 97-103 refs Sponsored by the Ministry of Education of Quebec (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15704# Worcester Polytechnic Inst., Mass.
MEASUREMENT OF SOIL THAW WEAKENING
J. D. Sage and R. A. DAndrea *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 105-112 refs Sponsored by DOT (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15705# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
COMPARISON OF UNFROZEN WATER CONTENTS MEASURED BY DSC AND NMR
Joseph L. Oliphant and Allen R. Tice *In its* Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 115-121 refs (For primary document see N83-15691 06-42)
(DA Proj. 4A1-61102-AT-2401)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15706# Research Inst. for Bases and Underground Structures, Moscow (USSR).
TEMPERATURE DEFORMATIONS OF FROZEN SOILS
V. D. Ponomarjov *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 125-130 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15707# Norges Tekniske Hoegskole, Trondheim. Lab. of Physical Chemistry.
THE HYDRAULIC CONDUCTIVITY OF SOILS DURING FROST HEAVE
Signe Kjelstrup Ratkje, Hideo Yamamoto, Tsutomu Takashi, Takahiro Ohrai, and Jun Okamoto *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 131-135 refs Prepared in cooperation with Seiken Co. Ltd., Minami-ku, Japan (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15708# Queens Univ., Belfast (Northern Ireland). Dept. of Civil Engineering.
THERMAL PROPERTIES OF SOILS RELEVANT TO GROUND FREEZING. DESIGN TECHNIQUES FOR THEIR ESTIMATION
Omar T. Farouki *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 139-146 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15709# Institute on Physical and Technical Problems of the North (USSR).
THERMOPHYSICAL CHARACTERISTICS OF FROZEN, FREEZING-THAWING, AND THAWED ROCKS AND METHODS OF THEIR MEASUREMENT
P. I. Philippov, A. V. Stepanov, and A. W. Timofeev *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 151-154 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15710# Ruhr Univ., Bochum (West Germany). Dept. of Civil Engineering.
MODELING THE INTERACTION BETWEEN SOIL FREEZING SYSTEM AND THERMAL REGIME IN SOILS USING FEM
Eugen Makowski *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 157-166 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15711# Kuibyshev Civil Engineering Inst., Moscow (USSR). Lab. for Engineering Cryopedology in Power Plant Construction.
THERMOMECHANICAL ENTHALPY MODEL FOR GROUND FREEZING DESIGN
Y. A. Kronik *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 167-176 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15712# Tokyo Gas Co. Ltd. (Japan). Production and Engineering Dept.
THERMAL ANALYSIS OF THE POSITION OF THE FREEZING FRONT AROUND AN LNG IN-GROUND STORAGE TANK WITH A HEAT BARRIER
o. Watanabe and M. Tanaka (Kajima Inst. of Construction Technology) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 3-10 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15713# Fisica Tecnica, Florence (Italy).
EXPERIMENTAL RESULTS ON THE FREEZING OF SATURATED SANDS
Fabio Gori and Maura Ughi (Ist. Matematico, Florence, Italy) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 185-191 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15715# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
FREEZING OF SOIL WITH SURFACE CONVECTION
V. J. Lunardini *In its* Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 205-212 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15716# Rutgers - The State Univ., Piscataway, N. J. Dept. of Civil and Environmental Engineering.
THERMAL MODELING OF FREEZE-THAW DEPTHS IN SOILS
Alfreds R. Jumikis *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 213-216 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15717# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
INITIAL STAGE OF THE FORMATION OF SOIL-LADEN ICE LENSES
Shunsuke Takagi *In its* Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 223-232 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15718# Ecole Nationale des Ponts et Chaussees, Paris (France).
CRYOGENIC SUCTION IN SOILS
D. Blanchard and M. Fremond (Lab. Central des Ponts et Chaussees) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 233-238 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15719# National Research Council of Canada, Ottawa (Ontario). Div. of Building Research.
ASPECTS OF ICE LENS FORMATION
E. Penner *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 239-245 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15720# Seiken Co. Ltd., Minami-ku (Japan).
EFFECT OF SPECIMEN HEIGHT ON FROST HEAVE RATIO IN UNIDIRECTIONAL FREEZING TEST OF SOIL
Tsutomu Takashi, Takahiro Ohrai, Hideo Yamamoto, and Jun Okamoto *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 247-254 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15721# Heilungkiang Provincial Low Temperature Construction Science Research Inst. (China).
FREEZING RATE AND FROST HEAVE OF SOILS
Liu Hongxu *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 255-259 (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15722# Shimizu Construction Co. Ltd. (Japan).
FROST HEAVE CHARACTERISTICS OF SOIL UNDER EXTREMELY LOW FROST PENETRATION RATE
Shigeru Goto and Yukishige Takahashi (Tokyo Gas Co. Ltd., Japan)

In CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 261-268 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15723# Shimizu Construction Co. Ltd. (Japan).
FROST HEAVE SUSCEPTIBILITY OF SATURATED SOIL UNDER CONSTANT RATE OF FREEZING
Kimitoshi Ryokai, Mizuhito Iguro, and Kiyoshi Yoneyama (Tokyo Gas Co. Ltd., Japan) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 269-276 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15724# Geos, Inc., Montreal (Quebec).
FROST SUSCEPTIBILITY TESTING OF A COMPACTED GLACIAL TILL
P. Garand and B. Ladanyi (Ecole Poytechnique, Montreal) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 277-284 refs Sponsored by Dept. of Education of Quebec (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08G

N83-15725# Aston Univ., Birmingham (England). Dept. of Civil Engineering.
HEAVING PRESSURES AND FROST SUSCEPTIBILITY
E. Y. McCabe and R. J. Kettle *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 285-294 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15726# Nottingham Univ. (England).
GROUND MOVEMENTS ASSOCIATED WITH ARTIFICIAL FREEZING
R. H. Jones *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 295-304 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15727# Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
FROST ACTION OF FREEZING GROUND SURROUNDING UNDERGROUND STORAGE OF A COLD LIQUID
Seiiti Kinosita, Masami Fukuda, Takeshi Ishizaki (Tokyo Gas Co. Ltd., Japan), and Hideo Yamamoto (Seiken Co. Ltd., Osaka) *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 305-309 refs (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

N83-15733# Lulea Univ. (Sweden).
FIELD STUDY OF INSTRUMENTED GULLIES AND MANHOLES IN FROST-SUSCEPTIBLE SOILS
Sven Knutsson *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 367-374 refs Sponsored by Swedish National Board for Technical Development and Swedish Council for Building Research (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/7

N83-15737# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
GROUND FREEZING IN TUNNELS: THREE UNUSUAL APPLICATIONS
Derek Maishman and J. Patrick Powers *In* CRREL Proc. of the 3d Intern. Symp. on Ground Freezing 1982 p 397-410 ref (For primary document see N83-15691 06-42)
Avail: NTIS HC A20/MF A01 CSCL 08/13

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N83-15982# Meteorological Satellite Center, Tokyo (Japan).
METEOROLOGICAL SATELLITE CENTER TECHNICAL NOTE NO. 6, 1982
Sep. 1982 91 p refs In ENGLISH and JAPANESE
(MSC-TN-6; ISSN-0388-9653) Avail: NTIS HC A05/MF A01

Various satellite-based weather forecasting techniques are discussed. For individual titles, see N83-15983 through N83-15988.

N83-15983# Meteorological Satellite Center, Tokyo (Japan).
PREDICTION OF TROPICAL CYCLONE INTENSITY USING EQUIVALENT BLACK BODY TEMPERATURES (T SUB BB) MEASURED BY GMS, PART 1
Kenji Shimada and Masao Uchida *In its* Meteorol. Satellite Center Tech. Note No. 6, 1982 Sep. 1982 p 1-10 refs In JAPANESE; ENGLISH summary (For primary document see N83-15982 06-47)
Avail: NTIS HC A05/MF A01

A relationship between central pressure of tropical cyclone and equivalent blackbody temperature measured by GMS near the storm center was investigated for thirty storms in the western North Pacific. The results showed not only a significant correlation but also a high lag relationship between central surface pressures and equivalent blackbody temperatures. Both the mean equivalent blackbody temperature in the area within 1 deg lat. from the center and that in the ring of 1 deg to 2 deg apart from the center showed the best correlation to the central surface pressure 24 hours after the observation time of GMS. Author

N83-15984# Meteorological Satellite Center, Tokyo (Japan).
DETERMINATION OF TYPHOON CENTER USING EQUIVALENT BLACK BODY TEMPERATURE (T SUB BB) DISTRIBUTION PATTERN
Syozo Hashimoto *In its* Meteorol. Satellite Center Tech. Note No. 6, 1982 Sep. 1982 p 11-22 refs In JAPANESE; ENGLISH summary (For primary document see N83-15982 06-47)
Avail: NTIS HC A05/MF A01

Determination of typhoon center using equivalent black body temperature distribution pattern is practiced by understanding a special feature of central cloud pattern which is analyzed with black body temperaure contour. The difference of typhoon center based on black body temperature distribution pattern relative to Japan Meteorological Agency (JMA) observation in 1981 was 42% within 0.2 degree of 187 cases for latitude and longitude. The large difference of more than 0.5 degrees was 12 percent. The disturbance of the cloud system became the weakening stage. The typhoon landed or approached land. It couldn't accurately get typhoon location in the black body temperature analysis area because the typhoon moved, increasing its speed. The low level circulation was not clear. Author

N83-15985# Meteorological Satellite Center, Tokyo (Japan).
MOISTURE FIELD ANALYSIS DERIVED FROM METEOROLOGICAL SATELLITE VERTICAL SOUNDING (NOAA-TOVS): CASE STUDY
Masakatsu Kato *In its* Meteorol. Satellite Center Tech. Note No. 6, 1982 Sep. 1982 p 23-33 refs In JAPANESE; ENGLISH summary (For primary document see N83-15982 06-47)
Avail: NTIS HC A05/MF A01

The usefulness of moisture information derived from TIROS Operational Vertical Sounder (TOVS) radiance data is examined qualitatively for the synoptic scale moisture field analysis. Three dimensional fields of derived moisture are analysed objectively and compared with the surface map, GMS pictures and initial moisture field at 700 mb level of 6L-FLM. The analysed three dimensional moisture fields are in good agreement with the moisture fields inferred from synoptic scale weather situation. Author

N83-15986# Meteorological Satellite Center, Tokyo (Japan).
REPRESENTATIVE HEIGHTS OF GMS SATELLITE WINDS
Tadaaki Hamada *In its* Meteorol. Satellite Center Tech. Note No. 6, 1982 Sep. 1982 p 35-47 refs (For primary document see N83-15982 06-47)

Avail: NTIS HC A05/MF A01

Seasonal variation of the representative height of cloud motion winds derived routinely from GMS images was studied by means of comparing the cloud winds with nearby radiosonde winds over Northern Hemisphere. A low-level satellite wind derived by man-machine interaction procedure of GMS Cloud Wind Estimation System (CWES) was compared with the radiosonde winds at 9 pressure levels (from 600 mb through 1000 mb at 50 mb intervals) reported by a nearby radiosonde station. Author

N83-15987# Meteorological Satellite Center, Tokyo (Japan).
EXTRACTION OF VISSR IMAGE DATA WITH A POLYGONAL SHAPE

Mikio Morikawa *In its* Meteorol. Satellite Center Tech. Note No. 6, 1982 Sep. 1982 p 49-58 refs In JAPANESE; ENGLISH summary (For primary document see N83-15982 06-47)

Avail: NTIS HC A05/MF A01

In order to investigate the development of cloud pattern using VISSR Image data taken by GMS, it is necessary to prepare the adequate partial VISSR Image data sets corresponding to the interest cloud target area. As a cloud shape is very complex generally, it is too difficult to extract precisely only the cloud data from VISSR Image. The method of extraction of partial VISSR data corresponding to the cloud area being approximated with a polygonal shape is developed. Author

N83-15988# Meteorological Satellite Center, Tokyo (Japan).
AUTOMATIC MEASUREMENT OF THE SATELLITE COMMUNICATION LINK CHARACTERISTICS **c32**

Yukito Tanaka *In its* Meteorol. Satellite Center Tech. Note No. 6, 1982 Sep. 1982 p 69-72 ref In JAPANESE; ENGLISH summary (For primary document see N83-15982 06-47)

Avail: NTIS HC A05/MF A01

The satellite communication link test, during the GMS-2 mission check, was automatically performed using the instruments under the control of a personal computer. The functions of the personal computer and the instruments used, and the measuring method of High Resolution (HR) facsimile link characteristics as an example are discussed. Author

N83-15989# Meteorological Satellite Center, Tokyo (Japan).
METEOROLOGICAL SATELLITE CENTER TECHNICAL NOTE NO. 5, 1982

Mar. 1982 101 p refs In ENGLISH and JAPANESE
(MSC-TN-5; ISSN-0388-9653) Avail: NTIS HC A06/MF A01

GMS imageries, TIROS-N vertical sounding theory, and a facsimile recorder are discussed. For individual titles, see N83-15990 through N83-15995.

N83-15990# Meteorological Satellite Center, Tokyo (Japan).
OBJECTIVE CLOUD TOP-HEIGHT ESTIMATION SYSTEM FOR GMS IMAGERIES

Kazuyasu Kato and Masakatsu Ishikawa *In its* Meteorol. Satellite Center Tech. Note No. 5, 1982 Mar. 1982 p 1-24 refs In ENGLISH and JAPANESE (For primary document see N83-15989 06-47)

Avail: NTIS HC A06/MF A01

Automation of a cloud top-height estimation system is described. The substantial information to realize an objective cloud top-height estimation system is an identification of representative measuring point within a cloud area and a cloud type. An objective cloud type classification method based on a maximum-likelihood classification technique, and a cloud selection technique based on both an edge detection method and a touching method were developed. Author

N83-15991# Meteorological Satellite Center, Tokyo (Japan).
THEORETICAL BACKGROUND OF THE VERTICAL SOUNDING FROM TIROS-N SATELLITE SERIES

Tadao Aoki *In its* Meteorol. Satellite Center Tech. Note No. 5, 1982 Mar. 1982 p 25-32 refs (For primary document see N83-15989 06-47)

Avail: NTIS HC A06/MF A01

Products from a vertical sounding system involve the vertical temperature profile, vertical precipitable water profile, total ozone amount, sea or ground surface temperature, the cloud parameters such as the cloud top height, cloud amount and cloud emissivity. The theoretical background of a data processing system for the retrieval of these atmospheric parameters is summarized. Author

N83-15992# Meteorological Satellite Center, Tokyo (Japan).
SOME CHARACTERISTIC FEATURES OF CLOUD LINES SEEN IN GMS IMAGERIES

Hideki Itoh and Takashi Tsuchiya *In its* Meteorol. Satellite Center Tech. Note No. 5, 1982 Mar. 1982 p 33-45 refs (For primary document see N83-15989 06-47)

Avail: NTIS HC A06/MF A01

Cloud lines consisting of cumulonimbi (Cb lines) are frequently observed in BMS imageries, especially in regions south of the main baroclinic zone. Such Cb lines are studied in the northwestern Pacific Ocean with respect to the morphological and analytical aspects. It is revealed tha the frequency of the occurrence of Cb lins is maximum in summer and minimum in winter. Spatial distribution of the occurrence of them is broader in autumn than in any other season. All the Cb lines in GMS imageries for three years are classified into even categories. Two different types of Cb lines are selected and analysed herein. According to the results of the analysis, it is clearly pointed out that a stable layer exists between 800 and 900 mb and a potentially unstable layer is observed under the stable layer on the eastern side of Cb lines. Such the unstable layer extends vertically up to 600 mb in just front of the cloud lines. This provides preferable condition to the development of convective clouds. In the rear of Cb lines, dry and stable and/or neutral condition is observed at lower and middle levels of the troposphere. Author

N83-15993# Meteorological Satellite Center, Tokyo (Japan).
THE GMS SATELLITE OBSERVATION OF VOLCANIC ERUPTIONS IN 1981 IN THE WESTERN PACIFIC

Hiroshi Yasoshina, Chieko Yata, Takashi Kanbayashi, and Nobuhiko Murayama (Meteorological Research Inst., Nagamine, Japan) *In its* Meteorol. Satellite Center Tech. Note No. 5, 1982 Mar. 1982 p 47-64 refs In JAPANESE, ENGLISH summary (For primary document see N83-15989 06-47)

Avail: NTIS HC A06/MF A01

Eruptions of Alaid volcano, Atlasova Island on April 27 and Pagan volcano, Mariana Islands on May 15, 1981 were observed on the GMS satellite images. Behavior of the volcanic plumes is discussed using sequences of GMS images, satellite cloud motions, radiosonde winds and meteorological analyses. The eruption times of the volcanoes being estimated from the sequences of the satellite images, the plume top height being confined in the troposphere, and the transport and meandering of the volcanic plume associated with wind field are presented. Author

N83-15994# Meteorological Satellite Center, Tokyo (Japan).
THE IMPROVEMENT OF HIGH RESOLUTION FACSIMILE RECORDER

Tsutoya Abe, Michio Hitani, Takao Suzuki, and Hiroaki Ohta *In its* Meteorol. Satellite Center Tech. Note No. 5, 1982 Mar. 1982 p 77-90 refs In JAPANESE, ENGLISH summary (For primary document see N83-15989 06-47)

Avail: NTIS HC A06/MF A01

In order to improve the quality of high resolution (HR) facsimile film image, some new techniques for HR facsimile recorder system were adopted. At first, a new laser tube was installed together with the change of single processing circuits because the original one was not produced. Secondly, because the density characteristics were not stable, the optical system was improved. As a result of this improvement, a stable and good image was obtained. Author

N83-15995# Meteorological Satellite Center, Tokyo (Japan).
NEW PROCEDURE OF HEIGHT ASSIGNMENT TO GMS SATELLITE WINDS

Tadaaki Hamada *In its* Meteorol. Satellite Center Tech. Note No.

5, 1982 Mar. 1982 p 91-95 refs In ENGLISH and JAPANESE Presented at the 11th Coord. Meeting on Geostationary Meteorol. Satellite, Washington, D.C., Feb. 1982 (For primary document see N83-15989 06-47)
Avail: NTIS HC A06/MF A01

The height assignment procedure for low-level winds and for high level winds on the basis of the results of the comparison of GMS satellite winds with radiosonde winds was determined. The new procedure of the height assignment is described. Author

N83-15996# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COURSE IN METEOROLOGICAL SATELLITES. PART B: APPLICATIONS AND PHOTOINTERPRETATION
Jorge Conrado Conforte, Nelson Arai, Fausto Carlos deAlmeida, Nelson deJesus Ferreira, Merrit Raymond Stevenson, Keiko Tanaka, Hector Manuel Inostroza Villagra, Marlene Elias et al [1982] 73 p refs In PORTUGUESE
(INPE-2235-MD/15-Pt-B) Avail: NTIS HC A04/MF A01

Chapters 10 through 14 of the course are presented. The following subjects are discussed: (1) navigation using imagery from geosynchronous meteorological satellites, (2) estimation of solar radiation reaching the surface of the Earth using satellite imagery, (3) the estimation of precipitation using data transmitted by meteorological satellites, (4) oceanographic application, and (5) the determination of temperature and water vapor profiles using satellite sounding. Transl. by J.D.

N83-15997*# Texas A&M Univ., College Station.
AVE/VAS 3: 25-MB SOUNDING DATA Interim Report
Meta E. Sienkiewicz Dec. 1982 309 p ref
(Contract NAS8-34133)
(NASA-CR-170692; NAS 1.26:170692) Avail: NTIS HC A14/MF A01 CSCL 04B

The rawinsonde sounding program for the AVE/VAS 3 experiment is described. Tabulated data are presented at 25-mb intervals for the 24 National Weather Service stations and 14 special stations participating in the experiment. Soundings were taken at 3-hr intervals, beginning at 1200 GMT on March 27, 1982, and ending at 0600 GMT on March 28, 1982 (7 sounding times). An additional sounding was taken at the National Weather Service stations at 1200 GMT on March 28, 1982, at the normal synoptic observation time. The method of processing soundings is briefly discussed, estimates of the RMS errors in the data are presented, and an example of contact data is given. Termination pressures of soundings taken in the mesos-beta-scale network are tabulated, as are observations of ground temperature at a depth of 2 cm. J.M.S.

N83-15998*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TEACHERS GUIDE FOR BUILDING AND OPERATING WEATHER SATELLITE GROUND STATIONS FOR HIGH SCHOOL SCIENCE
R. Joe Summers (Chambersburg Area Senior High School, Pa.) and Timothy Gotwald (Chambersburg Area Senior High School, Pa.) 1981 75 p refs Prepared in cooperation with NOAA, Washington, D.C.
(NASA-EP-184; NAS 1.19:184) Avail: NTIS HC A04/MF A01 CSCL 04B

A number of colleges and universities are operating APT direct readout stations. However, high school science teachers have often failed to realize the potential of meteorological satellites and their products as unique instructional tools. The ability to receive daily pictures from these satellites offers exciting opportunities for secondary school teachers and students to assemble the electronic hardware and to view real time pictures of Earth from outer space. The station and pictures can be used in the classroom to develop an approach to science teaching that could span many scientific disciplines and offer many opportunities for student research and participation in scientific processes. This can be accomplished with relatively small expenditures of funds for equipment. In most schools some of the equipment may already be available. Others can be constructed by teachers and/or students. Yet another source might be the purchase of used equipment from industry or through the government surplus channels. The information necessary for individuals unfamiliar with these systems to construct a direct readout for receiving real time APT photographs on a daily basis in the classroom is presented. S.L.

N83-15999# Pennsylvania State Univ., University Park. Dept. of Meteorology.
VALIDATION OF BULK TURBULENCE MODELING IN STABLE REGIMES Final Report
Robert E. Golus and Hans A. Panofsky Monterey, Calif. Naval Environmental Prediction Research Facility Aug. 1982 43 p refs
(Contract N00014-81-K-0302; WF59551)
(AD-A120022; NEPRF-CR-82-09) Avail: NTIS HC A03/MF A01 CSCL 04/2

A special set of observations of wind, temperature and moisture over Lake Ontario has been used to test bulk methods for computing stress, heat flux, evaporation, and structure constants, over a wide range of stabilities. Reasonably good results were obtained for the structure constant of temperature (C sub T squared). Bulk methods overestimated directly-measured stresses by about a factor of 2, possibly because wind speeds and wave speeds did not differ much from each other. The moisture content was estimated correctly in near-normal air, but the effect of stability variation was overestimated. There was a good correlation between observed heat flux measurements and heat flux estimated by the bulk method, but the bulk estimates exceeded the Reynolds fluxes by an average of about 7-8 watts/sq m. There are no systematic differences between bulk evaporation and Reynolds evaporation, but random scatter was considerable. GRA

N83-16000# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
A VERTICAL STRUCTURE ALGORITHM FOR LOW VISIBILITY/ LOW STRATUS CONDITIONS Final Report
Melvin G. Heaps Jun. 1982 49 p refs
(DA Proj. 1L1-61102-B-53)
(AD-A119977; ERADCOM/ASL-TR-0111) Avail: NTIS HC A03/MF A01 CSCL 04/2

Based on data describing the vertical structure in haze and fog, and on empirical parameterizations of that data, an algorithm of simple analytical form has been developed that describes the vertical structure for low visibility/low ceiling conditions. The algorithm describes the vertical structure for the visible extinction coefficient and liquid water content for two regimes: (1) the case of thick fogs and low stratus clouds, where the liquid water content is governed primarily by the wet adiabatic lapse rate; and (2) the case of hazes and thin fogs, where the vertical structure is determined by advection, radiative and conductive cooling, and hydration processes below and at saturation. GRA

N83-16001# Tel-Aviv Univ. (Israel). Faculty of Engineering.
STRATOSPHERIC TURBULENCE FROM WIND SHEARS Final Report
Norman Rosenberg 28 Feb. 1982 19 p refs
(F49620-81-C-0071; AF Proj. 6687)
(AD-A119980; AFGL-TR-82-0284) Avail: NTIS HC A02/MF A01 CSCL 04/2

A statistical analysis of smoke trail velocity profiles and balloon velocity profiles has been carried out to evaluate and remove their inherent noise content. The day-to-day variability in the probability of exceeding critical shear was evaluated. The corona anemometer data was compared with the much larger data-base of smoke trail data. Although the corona anemometer showed a higher probability of turbulence, it was within the variability expected from the smoke trail analysis. It is shown that the diffusion integral which leads to the diffusion coefficient is very sensitive to the variability in turbulent occurrence probabilities. Author (GRA)

N83-16002# Air Force Geophysics Lab., Hanscom AFB, Mass.
THE KEILSON-ROSS PROCEDURE FOR ESTIMATING CLIMATIC PROBABILITIES OF DURATION OF WEATHER CONDITIONS Environmental Research Papers
Irving I. Gringorten 1 Apr. 1982 28 p refs
(AF Proj. 6670)
(AD-A119860; AFGL-TR-82-0116; AFGL-ERP-775) Avail: NTIS HC A03/MF A01 CSCL 04/2

In a recent mathematical development the probability of the maximum of a continuous weather element, over a specified time interval, was computed analytically. As long as the weather condition is describable by a Markov (Ornstein-Uhlenbeck) process, the time interval could be a duration of a few seconds to a few weeks. The analytical solutions provide corrections to previous probability estimates that had been made by Monte Carlo simulation. There still remains, however, the requirement for rapid solutions. The adaptation of this problem to modern computers makes use of cubic B-splines, and provides answers with a high degree of accuracy. Author (GRA)

N83-16003# Air Force Geophysics Lab., Hanscom AFB, Mass.
INVESTIGATIONS OF LARGE SCALE STORM SYSTEMS Final Report
Arnold A. Barnes, Jr., Ian D. Cohen, and Donald W. McLeod 8 Jun. 1982 43 p refs
(AF Proj. 2310)
(AD-A119862; AFGL-TR-82-0169; AFGL-ERP-779) Avail: NTIS HC A03/MF A01 CSCL 04/2

The microphysics of Large Scale Cloud Systems (LSCS) was investigated by in-situ measurements made from two specially instrumented aircraft, a United States Air Force MC-180E and a Learjet 36. Information was obtained on the distribution of liquid and ice water content, particle size distributions, crystal habits, and other meteorological variables. The morphologies of three storms were investigated in detail as the storms crossed the United States. Author (GRA)

N83-16004# Air Force Geophysics Lab., Hanscom AFB, Mass.
CHANGES IN THE NATURE OF FLUCTUATIONS OF TEMPERATURE AND LIQUID WATER CONTENT DURING THE LIFETIME OF A LARGE-SCALE STORM Environmental Research Papers
R. M. Dyer and I. D. Cohen 6 May 1982 22 p refs
(AF Proj. 2310)
(AD-A119863; AFGL-TR-82-0147; AFGL-ERP-777) Avail: NTIS HC A02/MF A01 CSCL 04/2

The results of a spectral analysis of the horizontal fluctuations in temperature and liquid water content measured at four altitudes daily, during four days in the life cycle of a storm moving eastward across the United States, are discussed, along with a synoptic analysis of the storm. The storm itself was typical of the large scale systems traveling across the continent during the winter season. Each stage of the storm (development, maturity, and dissipation) exhibited distinctive spectral characteristics. In addition, the evidence is strong that the age and previous history of the system greatly affect the fluctuation spectra. The results of this study support the thesis of a characteristic spectral signature for cloud systems as well as for single clouds. This method may be used to determine the present growth stage of a storm system and its potential for future development. GRA

N83-16005# Science Applications, Inc., Monterey, Calif.
WIND PROBABILITIES AND TROPICAL CYCLONE READINESS CONDITIONS Final Contractor Report
Jerry D. Jarrell Sep. 1982 42 p refs
(Contract N00028-81-C-H361)
(AD-A120040; SAI-PN-1-425-08-453; NEPRF-CR-82-12) Avail: NTIS HC A03/MF A01 CSCL 04/2

Wind probabilities are examined in relation to the establishment of tropical cyclone readiness conditions at Apra Harbor, Guam, and at Kadena AFB, Okinawa, Japan. By fitting a conceptual model to the data, decision zones are delineated for setting each condition. While these results apply strictly to the two stations alone, the concepts are general and can be made to apply to other bases and other problems. Author (GRA)

N83-16006# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
IMPACT OF SPACIAL AND TEMPORAL FREQUENCY OF METEOROLOGICAL DATA ON FIELD ARTILLERY ACCURACY Final Report
J. D. Copp Aug. 1982 38 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A120642; ERADCOM/ASL-TR-9113) Avail: NTIS HC A03/MF A01 CSCL 19/5

The effect of spacial and temporal frequency of radiosonde data on artillery accuracy is analyzed for the 8-in (short tube) and 155 mm (long tube) weapon systems. Range and deflection elliptical probable errors for hitting a stationary target are calculated for various firing scenario using real meteorological data from central Europe. The individual errors due to variability and uncertainty in wind, temperature, and density measurements are also analyzed for several of the firing examples. GRA

N83-16007# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
MICROPHYSICAL PROPERTIES OF FOG AT OTIS AIR FORCE BASE Final Scientific Report
Bruce A. Kunkel 26 Jan. 1982 113 p refs
(AF Proj. 6670)
(AD-A119928; AFGL-TR-82-0026; AFGL-ERP-767) Avail: NTIS HC A06/MF A01 CSCL 04/2

To develop improved techniques for predicting advection fog, fog droplet spectra data were collected during several advection fog episodes at Otis AFB. The data were collected with two PMS forward scatter probes (FSSP-100) and two optical array probes (OAP-200X). These two probes cover the ranges from 0.5 to 47 micrometers and 20 to 300 micrometer diameter, respectively. The probes were mounted at 5 m and 30 m above the ground. Drop size data were obtained in nine fogs over a total period of 70 h. Other data that were collected continuously during the fog episodes include extinction coefficient, temperature, dew point, wind direction, and speed at the 5, 15, 30, 45, 60 m levels. The droplet data show three basic types of spectra, all of which have a high droplet count below 2.5 micrometer diameter. Some spectra show as many as three modes while others show no modes within the size range of the instruments. The shape of the droplet spectra and the number concentration vary considerably from one fog to another and during a fog episode. The total droplet concentration appears to be a function, primarily, of the past trajectory of the air mass; lower counts being observed in air masses with long over water trajectories. The drop-size data were used to parameterize the extinction coefficient and the mean droplet terminal velocity in terms of liquid water content and droplet concentration for use in numerical prediction models. The new parameterizations will result in the prediction of lower liquid-water contents and higher visibilities than with previous parameterization used in fog prediction models. GRA

N83-16008# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.
APPLICATION OF QUASI-LAGRANGIAN DIAGNOSTICS TO THE STUDY OF NUMERICALLY-SIMULATED OCEANIC CYCLONES M.S. Thesis
William C. Tallman Jun. 1982 122 p refs
(AD-A120449) Avail: NTIS HC A06/MF A01 CSCL 04/2

A study of two oceanic extratropical cyclones, generated by the navy operational atmospheric prediction system (NOGAPS) model reveals a simultaneous development of the upper and lower tropospheric features while these features maintain their positions relative to each other. These cyclones also develop extreme shear in most synoptic fields after 120 hours of numerical simulation. The mass budgers of these cyclones show a concentration of inward lateral transport (convergence) in the lowest model layer and outward lateral transport (divergence) in a layer centered near 300 mb. Time sections of lateral transport, vertical velocity and

mass tendency reveal that these cyclones develop in two phases: an explosive cyclogenesis phase, and a quasisteady state phase. These time sections also reveal a 12 hour cyclic pattern embedded within the two phases of cyclone evolution. This 12 hour cyclic pattern is not evident in the map sequences of the surface pressure. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N83-16009# Delaware Univ., Newark. Dept. of Civil Engineering.
COMPUTER ALGORITHM TO CALCULATE LONGSHORE ENERGY FLUX AND WAVE DIRECTION FROM A TWO PRESSURE SENSOR ARRAY
Todd L. Walton, Jr. and Robert G. Dean Fort Belvoir, Va. Army Coastal Engineering Research Center Aug. 1982 36 p refs (AD-A119990; CERC-TP-82-2) Avail: NTIS HC A03/MF A01 CSCL 08/3

A documented (FORTRAN IV) computer program is discussed as originally written for the CERC Longshore Sand Transport Research Program to analyze wave data collected at Channel Islands Harbor, California. The program performs the basic analysis of two wave gage pressure records necessary to compute wave direction and wave energy at a given frequency and computes the longshore energy flux used in sand transport for the entire energy spectrum of the wave record. This program uses linear wave theory for the wave transformation process and includes the assumption of straight and parallel bottom contours necessary for application of Snell's law of refraction. The necessary steps in an analysis of wave data and sample outputs for some wave records from the Channel Islands wave gage pressure sensor pair are given. The program presently accepts data in the standard CERC magnetic-tape format where record lengths consist of 4,100 values. Author (GRA)

N83-16010# Scripps Institution of Oceanography, La Jolla, Calif. Marine Physical Lab.
MARINE PHYSICAL LABORATORY PROGRAM IN ACOUSTICS AND THE OCEAN ENVIRONMENT Final Contract Report, 1 Oct. 1974 - 31 Oct. 1980
F. Spiess and V. C. Anderson 1 Sep. 1982 49 p refs (Contract N00014-75-C-0704)
(AD-A120862; MPL-U-43/82) Avail: NTIS HC A03/MF A01 CSCL 10/1

The Marine Physical Laboratory conducted a diverse program of investigations in the field of acoustics, both in the water and on the seafloor. The results have provided a better understanding of the effects of the ocean and its interfaces on the generation, propagation, and applications of acoustic energy, with specific application to problems of Navy interest. In addition, they have contributed toward increased knowledge in other aspects of marine science: geology, biology, chemistry, and physical oceanography. The research work is listed in project summaries. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N83-16011# Army Intelligence and Threat Analysis Center, Arlington, Va.
MILITARY MEDICAL JOURNAL, NO. 7, 1982
1982 134 p refs Transl. into ENGLISH of Voenno-Med. Zh. (Moscow), No. 7, Jul. 1982
(L-2129) Avail: NTIS HC A07/MF A01

Heat adaptation, thermal stress, and the effect of Coriolis acceleration are discussed. For individual titles, see N83-16012 through N83-16014.

N83-16012# Army Intelligence and Threat Analysis Center, Arlington, Va.
MILITARY LABOR HYGIENE AND PHYSIOLOGY c52
A. T. Maryanovich *In its* Mil. Med. J., No. 7, 1982 (L-2129) 1982 p 58-61 refs Transl. into ENGLISH from Voenno-Med. Zh. (Moscow), No. 7, Jul. 1982 (For primary document see N83-16011 06-51)
Avail: NTIS HC A07/MF A01

The assumption that fractional exposure to the thermal factor at high intensity causes more strongly expressed adaptive changes in the human organism than ordinary continuous conditions was tested. Author

N83-16013# Army Intelligence and Threat Analysis Center, Arlington, Va.
ANALYSIS OF THERMAL STRESS EVALUATION METHODS c52
V. P. Kovalenko and V. V. Pastukhov *In its* Mil. Med. J., No. 7, 1982 (L-2129) 1982 p 62-64 Transl. into ENGLISH from Voenno-Med. Zh. (Moscow), No. 7, Jul. 1982 (For primary document see N83-16011 06-51)
Avail: NTIS HC A07/MF A01

The thermal status was evaluated by the rectal temperature and weighted mean skin temperature as measured at 11 points. The functional status of the cardiovascular system was studied by mechanocardiography, electrocardiography and plethismography. Respiration was studied by determining gas metabolism and recording the respiration frequency. The functional status of the central nervous system was studied by means of the reaction to a moving object, simple sensiomotor reactions and by the correction test with Landolt rings. The functional status of the motor analyzer was determined by measuring the maximum and static endurance of the muscles of the land, and also the static and dynamic tremor. The Weber-Vivkin method was used to study skin discrimination sensitivity. The status of the sympathetic-adrenal system was evaluated from the quantity of 17-oxycordicosteroids, creatinine and urea excreted with the urine. Carbohydrate metabolism was studied from the content of lactic and pyruvic acid in the blood. Author

N83-16014# Army Intelligence and Threat Analysis Center, Arlington, Va.
DYNAMICS OF CERTAIN PSYCHOPHYSIOLOGICAL INDICES UPON EXPOSURE TO CUMULATED CORIOLIS ACCELERATION c53
V. I. Babiyak, L. A. Glaznikov, and V. A. Mozin *In its* Mil. Med. J., No. 7, 1982 (L-2129) 1982 p 65-69 refs Transl. into ENGLISH from Voenno-Med. Zh. (Moscow), No. 7, Jul. 1982 (For primary document see N83-16011 06-51)
Avail: NTIS HC A07/MF A01

The dynamics of psychophysiologic changes in persons with varying degrees of resistance to rocking were studied. An automation system for recording and statistically processing simple and complex sensiomotor reactions before and after exposure to continuous cumulation of Coriolis acceleration (CCCA) was used. Author

N83-16015# Naval Oceanographic Office, Washington, D. C.
A PROTOTYPE BIOLUMINESCENCE PHOTOMETER
Mark L. Geiger Feb. 1981 59 p refs
(AD-A119807; NOO-TR-280) Avail: NTIS HC A04/MF A01 CSCL 08/1

A bioluminescence photometer system, a vertically-lowered device that records flashes of light produced when small bioluminescent marine organisms are pumped into a turbulent flow regime chamber where they are viewed by a photomultiplier tube, is discussed. The history and performance of this device are documented. The combined results of experience at sea and engineering performance evaluations suggest that the present instrument is a useful tool for mapping dinoflagellate bioluminescence capabilities within the upper ocean. A recent modification (based on a twelve-conductor set of winch slip rings) allowed continuous profiles of dinoflagellate light production to be recorded

without significant decreases in sensitivity or signal degradation by noise. The present instrument is not useful for underway work or for measuring light produced by organisms of approximately 400 microns in length and larger. Several improvements can be made on the present device by experimenting with underway systems and with chamber sizes, shapes and flow regimes. GRA

N83-16016# Illinois Univ., Urbana-Champaign. Dept. of Botany.
DEVELOPMENT AND FUNCTION OF MEMBRANE SYSTEMS IN PLANT TISSUE Progress Report, 15 Jul. 1980 - 15 Sep. 1981
1 Oct. 1981 9 p refs
(Contract DE-AS02-76EV-00790)
(DE82-002113; DOE/EV-00790/005) Avail: NTIS HC A02/MF A01

Over the past 14 months, investigations of ion transport mechanisms in corn roots and mitochondria have continued. With mitochondria, citrate and malate can be transported by a mechanism that does not involve exchange for phosphate. Evidence exists for an anion/H+ co-transport mechanism which will function under both energized and passive conditions. In the root investigations, it was found that any injury or shock results in blockage of the H+ efflux pumping mechanism, and that FC restores the activity. Studies with inhibitors indicate the H+ channel of the ATPase to be the site of control. Injury or shock appears to act by making the membrane permeable to Ca2+, which appears to directly or indirectly act to inhibit the ATPase. Preliminary work with isolated plasma-lemma preparations supports this view. DOE

N83-16017# Pacific Northwest Lab., Richland, Wash.
HISTOPATHOLOGIC, MORPHOMETRIC, AND PHYSIOLOGIC INVESTIGATION OF LUNGS OF DOGS EXPOSED TO URANIUM-ORE DUST
F. T. Cross, R. E. Filipy, S. M. Loscutoff, P. J. Mihalko, R. F. Palmer, and R. H. Busch 1981 8 p refs Presented at the Intern. Conf. on Radiation Hazards in Mining: Control, Measurement, and Medical Aspects, Golden, Col., 4 Oct. 1981
(Contract DE-AC06-76RL-01830)
(DE82-003855; PNL-SA-9927; CONF-8110111-2) Avail: NTIS HC A02/MF A01

The most consistent pulmonary function change attributed to carnotite uranium ore dust exposure is an increased slope of the single breath N2 washout curve, suggesting an uneven distribution of ventilation. This change was observed in dogs exposed for less than 1 year and continued through 4 years of exposure. Measurements of pulmonary resistance, after 27, 40 and 47 months exposure, showed slight age related changes and increasing differences between control and exposed animals with duration of exposure. These two changes are suggestive of a bronchitic response, similar to the industrial bronchitis of mine workers. The most notable pulmonary lesions observed in dogs exposed for up to 4 years are: vesicular emphysema, peribronchiolitis and focal pneumoconiosis. Lesions of the major airways and upper respiratory tract, when present, were minimal in severity. Pulmonary vesicular emphysema was present in all but one of the examined dogs. DOE

N83-16022*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
METABOLIC EFFECTS OF HYPERGRAVITY ON EXPERIMENTAL ANIMALS
Jiro Oyama *In its* Space Gerontology Nov. 1982 p 37-52 (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06C

N83-16023*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF HYPERGRAVITY ON RAT LIVER REGENERATION
David D. Feller *In its* Space Gerontology Nov. 1982 p 53-54 (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06C

N83-16025*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF WEIGHTLESSNESS ON BONE AND MUSCLE OF RATS
Emily M. Holton *In its* Space Gerontology Nov. 1982 p 59-66 (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06C

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N83-16018*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE GERONTOLOGY
Jaime Miquel, ed. and Angelos C. Economos, ed. (Technology, Inc., Mountain View, Calif.) Washington Nov. 1982 125 p refs Workshop held at Moffett Field, Calif., 30-31 Jan. 1978
(NASA-CP-2248; A-8627; NAS 1.55:2248) Avail: NTIS HC A06/MF A01 CSCL 06S

Presentations are given which address the effects of space flight on the older person, the parallels between the physiological responses to weightlessness and the aging process, and experimental possibilities afforded by the weightless environment to fundamental research in gerontology and geriatrics. For individual titles, see N83-16019 through N83-16033.

N83-16019*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPARISON BETWEEN THE WEIGHTLESSNESS SYNDROME AND AGING
Jaime Miquel *In its* Space Gerontology Nov. 1982 p 1-8 refs (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06S

The similarity of detrimental effects of normal aging and of exposure to space weightlessness is discussed. The effects include: the reduction in cardiac output, increase in blood pressure, decrease in respiratory vital capacity, decrease in lean body weight and muscle mass, collagen and fat infiltration of muscle, bone demineralization, and a decrease in urinary excretion of total 17-hydroxicorticosteroids. It is also noted that dispite the accelerated aging of organisms, if animals or human subjects were to spend their entire lives in weightlessness, their lifespans might be significantly increased because of a reduction in metabolic rate. Experimental results are cited. M.G.

N83-16020*# Stanford Univ., Calif. Dept. of Pathology.
A PATHOLOGIST'S VIEW ON THE EFFECTS OF VERY LONG EXPOSURE TO WEIGHTLESSNESS
Klaus G. Bensch *In* NASA. Ames Research Center Space Gerontology Nov. 1982 p 9-11 (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06S

Speculations concerning the probable consequences of exposure to weightlessness during periods of one year or more and how these effects compare with aging are made. Orthostatic and excercise intolerance, neurological and muscular effects, cell division and DNA synthesis, tissue hypoxia, and edema are discussed in reference to the in-space and return-to-Earth situations. M.G.

N83-16021*# Technology, Inc., Mountain View, Calif. Life Sciences Div.
HUMAN HOMEOSTASIS IN THE SPACE ENVIRONMENT: A SYSTEMS SYNTHESIS APPROACH
Angelos C. Economos *In* NASA. Ames Research Center Space Gerontology Nov. 1982 p 13-36 refs (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06S

The features of homeostatic changes which occur during adaptation to the weightless state are examined and the possible

mechanisms underlying the responses are explored. Cardiac output, negative fluid balance, body weight, bone calcium, and muscle atrophy are discussed. Some testable hypotheses concerning possible effects on homeostasis that long-term exposure to weightlessness might cause are proposed. M.G.

N83-16022*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
METABOLIC EFFECTS OF HYPERGRAVITY ON EXPERIMENTAL ANIMALS **c51**
Jiro Oyama *In its* Space Gerontology Nov. 1982 p 37-52 (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06C

Several experiments concerned with the exposure of animals to acute or chronic centrifugation are described. The effects of hypergravity particularly discussed include the decreased growth rate and body weight, increased metabolic rate, skeletal deformation, and loss of body fat. M.G.

N83-16023*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF HYPERGRAVITY ON RAT LIVER REGENERATION **c51**
David D. Feller *In its* Space Gerontology Nov. 1982 p 53-54 (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06C

The effects of centrifugation on liver regrowth were examined by measuring mitotic activity. The results indicate that the increased gravity caused a delay in the onset of mitotic activity and a significant decrease in overall mitotic activity. M.G.

N83-16024*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE WEIGHTLESSNESS AND HORMONAL CHANGES IN HUMAN SUBJECTS AND EXPERIMENTAL ANIMALS
Richard E. Grindeland *In its* Space Gerontology Nov. 1982 p 55-57 (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06S

Data from spaceflight and bed rest studies are briefly described and the difficulties in interpreting these results are discussed. Growth hormone, prolactin, adrenocorticotropic hormone, cortisol, insulin, aldosterone, and other hormones are addressed. M.G.

N83-16025*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF WEIGHTLESSNESS ON BONE AND MUSCLE OF RATS **c51**
Emily M. Holton *In its* Space Gerontology Nov. 1982 p 59-66 (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06C

Experiments studying the metabolic effects of hypogravity as related to muscle disuse atrophy and bone decalcification are discussed. M.G.

N83-16026*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECT OF EXERCISE ON THE PSEUDODIABETES OF BED REST
John E. Greenleaf *In its* Space Gerontology Nov. 1982 p 67-74 refs (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06S

The effect of intensive isotonic exercise and isometric exercise (with its low metabolic rate) during bed rest on plasma insulin and glucose tolerance test was investigated. The subjects were seven healthy men, 19 to 22 years in age, 166 to 188 cm in height, and 62.40 to 103.80 kg in weight; maximal oxygen uptakes ranged from 3.36 to 4.38 liters/min. It appears that bed-rest-induced glucose intolerance is diminished with increasing energy expenditure during both bed rest and recovery. M.G.

N83-16027*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LIFE SCIENCES EXPERIMENTS ON THE SPACE SHUTTLE **c54**
Richard D. Johnson *In its* Space Gerontology Nov. 1982 p 75-79 (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 05H

The facilities afforded by the space shuttle/Spacelab to conduct life science experiments are described. Laboratory arrangement, specimen holding, and instrumentation are discussed. M.G.

N83-16028*# Argonne National Lab., Ill. Div. of Biomedical Research.
ENERGY METABOLISM AND LIFESPAN
George Sacher *In* NASA. Ames Research Center Space Gerontology Nov. 1982 p 81-84 refs (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06S

An experiment to determine how the longevity of individual animals and genotypes within species depended on body weight and metabolic rate is described. M.G.

N83-16029*# Michigan State Univ., East Lansing. Dept. of Physiology.
THE NEUROENDOCRINE SYSTEM AND AGING
Joseph Meites *In* NASA. Ames Research Center Space Gerontology Nov. 1982 p 85-87 (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06S

The role of the neuroendocrine system in aging processes is discussed with an emphasis on the decline of reproductive function, using rate as a model. M.G.

N83-16030*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SUMMARY OF SPACE GERONTOLOGICAL IDEAS
Angelos C. Economos (Technology, Inc., Mountain View, Calif.) and Jaime Miquel *In its* Space Gerontology Nov. 1982 p 99-102 (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06S

Several hypotheses relating the effects of weightlessness and the aging process are proposed and commented on. M.G.

N83-16031*# Technology, Inc., Mountain View, Calif. Life Sciences Div.
TOPICS IN SPACE GERONTOLOGY: EFFECTS OF ALTERED GRAVITY AND THE PROBLEM OF BIOLOGICAL AGE
Angelos C. Economos *In* NASA. Ames Research Center Space Gerontology Nov. 1982 p 103-111 refs (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06S

The use of altered gravity experimentation as a gerontological research tool is examined and a rationale for a systems approach to the adaptation to spaceflight is presented. The dependence of adaptation capacity on biological age is also discussed. M.G.

N83-16032*# Civil Aeromedical Inst., Oklahoma City, Okla.
AGING AND SPACE TRAVEL
Stanley R. Mohler *In* NASA. Ames Research Center Space Gerontology Nov. 1982 p 113-118 refs Repr. from Aerospace Med., v. 33, 1962 p 594-597 (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06S

The matter of aging and its relation to space vehicle crewmembers undertaking prolonged space missions is addressed. The capabilities of the older space traveler to recover from bone demineralization and muscle atrophy are discussed. Certain advantages of the older person are noted, for example, a greater tolerance of monotony and repetitious activities. Additional parameters are delineated including the cardiovascular system, the reproductive system, ionizing radiation, performance, and group dynamics. M.G.

N83-16033*# California Univ., Los Angeles. Neuropsychiatric Inst.
AEROSPACE GERONTOLOGY
Alex Comfort *In* NASA. Ames Research Center Space Gerontology Nov. 1982 p 119-122 Repr. from the book "The Biology of

Senescence" Elsevier North Holland, Inc., 1979 (For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 06S

The relevancy of gerontology and geriatrics to the discipline of aerospace medicine is examined. It is noted that since the shuttle program gives the facility to fly passengers, including specially qualified older persons, it is essential to examine response to acceleration, weightlessness, and re-entry over the whole adult lifespan, not only its second quartile. The physiological responses of the older person to weightlessness and the return to Earth gravity are reviewed. The importance of the use of the weightless environment to solve critical problems in the fields of fundamental gerontology and geriatrics is also stressed. M.G.

N83-16034# Army Intelligence and Threat Analysis Center, Arlington, Va.
MILITARY MEDICAL JOURNAL, NO. 6, 1982
30 Oct. 1982 139 p refs Transl. into ENGLISH of Voenno-Med. Zh. (Moscow), No. 6, Jun. 1982
(L-2003) Avail: NTIS HC A07/MF A01

Different aspects of medical treatment are presented, including: intra-articular fracture of the tibial condules, purulent infection and heart disease. Medical problems in miliary situations are also discussed. For individual title, see N83-16035.

N83-16035# Army Intelligence and Threat Analysis Center, Arlington, Va.
DIAGNOSIS OF CARDIAC RHYTHM AND CONDUCTIVITY DISORDERS AND THEIR EXPERT EVALUATION AMONG FLIGHT PERSONNEL
V. A. Koledenok, V. M. Kondrakov, and N. A. Lysogor *In its* Mil. Med. J., No. 6, 1982 (L-2003) 30 Oct. 1982 p 65-70 refs Transl. into ENGLISH from Voenno-Med. Zh. (Moscow), No. 6, Jun. 1982 (For primary document see N83-16034 06-52)
Avail: NTIS HC A07/MF A01

The frequency of cardiac rhythm disorders and conductivity disorders in flight personnel at rest and with measured physical loads was studied. The results of clinical and instrumental examination of a large number of flight personnel 20 to 54 years of age were analyzed. In 13.9% of the cases the subjects, when at rest and when exercising at submaximal rates, revealed various forms of arrhythmias and intracardiac block. Depending on the final diagnosis these persons were divided into five groups. S.L.

N83-16012# Army Intelligence and Threat Analysis Center, Arlington, Va.
MILITARY LABOR HYGIENE AND PHYSIOLOGY
A. T. Maryanovich *In its* Mil. Med. J., No. 7, 1982 (L-2129) 1982 p 58-61 refs Transl. into ENGLISH from Voenno-Med. Zh. (Moscow), No. 7, Jul. 1982 (For primary document see N83-16011 06-51)
Avail: NTIS HC A07/MF A01

N83-16013# Army Intelligence and Threat Analysis Center, Arlington, Va.
ANALYSIS OF THERMAL STRESS EVALUATION METHODS
V. P. Kovalenko and V. V. Pastukhov *In its* Mil. Med. J., No. 7, 1982 (L-2129) 1982 p 62-64 Transl. into ENGLISH from Voenno-Med. Zh. (Moscow), No. 7, Jul. 1982 (For primary document see N83-16011 06-51)
Avail: NTIS HC A07/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N83-16036# Harvard Univ., Cambridge, Mass. Dept. of Statistics.
VARIABLES ON SCATTERPLOTS LOOK MORE HIGHLY CORRELATED WHEN THE SCALES ARE INCREASED
William S. Cleveland, Persi Diaconis, and Robert McGill Jan. 1982 12 p
(Contract N00014-79-C-0512; Grant NSF MCS-79-08685)
(AD-A120740; PJH-12) Avail: NTIS HC A02/MF A01 CSCL 12/1

Subjects were shown scatterplots and were asked to judge the amount of association between the two variables. Judged association increased when the scales on the horizontal and vertical axes were simultaneously increased so that the size of the point cloud within the frame of the plot decreased. Judges association was very different from the correlation coefficient, r, which is the most widely used measure of association. Author (GRA)

N83-16014# Army Intelligence and Threat Analysis Center, Arlington, Va.
DYNAMICS OF CERTAIN PSYCHOPHYSIOLOGICAL INDICES UPON EXPOSURE TO CUMULATED CORIOLIS ACCELERATION
V. I. Babiyak, L. A. Glaznikov, and V. A. Mozin *In its* Mil. Med. J., No. 7, 1982 (L-2129) 1982 p 65-69 refs Transl. into ENGLISH from Voenno-Med. Zh. (Moscow), No. 7, Jul. 1982 (For primary document see N83-16011 06-51)
Avail: NTIS HC A07/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N83-16037*# Ohio State Univ., Columbus. Industrial and Systems Engineering.
USE OF COMPUTER-AIDED TESTING IN THE INVESTIGATION OF PILOT RESPONSE TO CRITICAL IN-FLIGHT EVENTS, VOLUME 1 Final Report, 1 Apr. 1981 - 30 Sep. 1982
Thomas H. Rockwell and Walter C. Giffin 30 Dec. 1982 160 p refs 2 Vol.
(Grant NAG2-112)
(NASA-CR-169720; NAS 1.26:169720) Avail: NTIS HC A08/MF A01 CSCL 05H

Development of computer aided formats, results of computer aided testing, learning in computer aided testing of critical in-flight event (CIFE) diagnosis and computer aided prompting are considered. N.W.

N83-16038*# Ohio State Univ., Columbus. Industrial and Systems Engineering.
USE OF COMPUTER-AIDED TESTING IN THE INVESTIGATION OF PILOT RESPONSE TO CRITICAL IN-FLIGHT EVENTS. VOLUME 2: APPENDIX Final Report, 1 Apr. 1981 - 30 Sep. 1982
Thomas H. Rockwell and Walter C. Giffin 30 Dec. 1982 142 p 2 Vol.
(Grant NAS2-112)
(NASA-CR-169721; NAS 1.26:169721) Avail: NTIS HC A07/MF A01 CSCL 05H

Computer displays using PLATO are illustrated. Diagnostic scenarios are described. A sample of subject data is presented. Destination diversion displays, a combined destination, diversion scenario, and critical in-flight event (CIFE) data collection/subject testing system are presented. Author

N83-16039*# California Univ., Davis. Plant Growth Lab.
UTILIZATION OF UREA, AMMONIA, NITRITE, AND NITRATE BY CROP PLANTS IN A CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEM (CELSS)
R. C. Huffaker, D. W. Rains, and C. O. Qualset Oct. 1982 50 p refs
(Contract NCC2-99)
(NASA-CR-166417; NAS 1.26:166417; CELSS-21) Avail: NTIS

HC A03/MF A01 CSCL 06K

The utilization of nitrogen compounds by crop plants is studied. The selection of crop varieties for efficient production using urea, ammonia, nitrite, and nitrate, and the assimilation of mixed nitrogen sources by cereal leaves and roots are discussed. S.L.

N83-16040*# Boeing Aerospace Co., Seattle, Wash.
CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEM: TRANSPORTATION ANALYSIS Final Report
Edith Gustan and Tim Vinopal Nov. 1982 126 p refs
(Contract NAS2-11148)
(NASA-CR-166420; NAS 1.26:166420; CELSS-22) Avail: NTIS HC A07/MF A01 CSCL 06K

This report discusses a study utilizing a systems analysis approach to determine which NASA missions would benefit from controlled ecological life support system (CELSS) technology. The study focuses on manned missions selected from NASA planning forecasts covering the next half century. Comparison of various life support scenarios for the selected missions and characteristics of projected transportation systems provided data for cost evaluations. This approach identified missions that derived benefits from a CELSS, showed the magnitude of the potential cost savings, and indicated which system or combination of systems would apply. This report outlines the analytical approach used in the evaluation, describes the missions and systems considered, and sets forth the benefits derived from CELSS when applicable. Author

N83-16041# ILC Dover, Frederica, Del. Protective Equipment Div.
IMPROVED VISOR MATERIAL FOR DPE OUTERGARMENT Final Report, 7 Jul. 1980 - 22 Jan. 1982
Robert Alegra 22 Jan. 1982 62 p
(Contract DAAK11-79-C-0066)
(AD-A120066) Avail: NTIS HC A04/MF A01 CSCL 11/9

This task was authorized to investigate alternative materials for the current PVC visor of the DPE Outergarment that will increase the shelf life of Outergarment without affecting its protective capability. A material search and test program isolated an Ionomer (Surlyn) as the improved material for the visor, and a functional test program verified the suitability of Surlyn as the visor material in the DPE Outergarment. Author (GRA)

N83-16042# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
DYNAMICALLY STABLE LEGGED LOCOMOTION Technical Report, 1 Dec. 1980 - 30 Sep. 1981
Marc H. Raibert, H. Benjamin Brown, Jr., Michael Chepponis, Eugene Hastings, and Steven E. Shreve 30 Nov. 1981 75 p refs
(Contract MDA903-81-C-0130; ARPA Order 4148)
(AD-A120692; CMU-RI-TR-81-9) Avail: NTIS HC A04/MF A01 CSCL 06/4

Though vehicles that use legs for locomotion promise superior mobility and versatility, very little is known about their design and control. Balance, resonance, and dynamic control are key issues underlying high performance legged systems, both man-made and biological, yet understanding in these areas is particularly lacking. We focus attention on these important problems by studying hopping systems that have only one leg. A one-legged system must hop to locomote, must balance to hop, and must be dynamically controlled at all times to balance. An ideal one-legged planar hopping machine is presented with its equations of motion. Control is decomposed into a vertical hopping part and a horizontal balance part. A total vertical energy measure is used to control uniformity of hopping height when there are mechanical losses and irregular terrains. Balance and control of horizontal translation are explored through implementation of three controllers: a linear feedback controller, a stance controller, and a new table look-up controller. The design and operation of a physical planar hopping machine is discussed, along with preliminary experimental results for vertical control. Three new designs for experimental vehicles that operate in 3-space are presented. Two are mechanically simple designs with functional symmetry; the third is preliminary concept for a multi-legged balancing vehicle that is optimized for forward motion. Author (GRA)

N83-16043# Georgia Inst. of Tech., Atlanta. Production and Distribution Research Center.
IRG (INTERACTIVE ROUTE GENERATOR): A NARRATIVE DESCRIPTION
Frank H. Cullen, John J. Jarvis, and H. Donald Ratliff Feb. 1982 30 p refs
(Contract N00014-80-K-0709)
(AD-A120741; PDRC-82-15) Avail: NTIS HC A03/MF A01 CSCL 09/2

The IRG system can be described in two general environments; a physical environment, which is mainly concerned with what components are where; and the philosophical environment, which is principally concerned with methodological issues such as division of labor between the man and the machine and the underlying mathematical models. We will begin this section with a brief discussion of the philosophical environment with the intent of motivating the ensuing discussion of the system's physical components. GRA

N83-16044# Naval Submarine Medical Center, Groton, Conn.
CONTRAST SENSITIVITY MEASURED IN LOW LEVELS OF RED, WHITE, AND BLUE AMBIENT ILLUMINATION Interim Report
David F. Neri and Jo Ann S. Kinney 19 Aug. 1982 16 p refs
(MO100PN001)
(AD-A119920; NSMRL-989) Avail: NTIS HC A02/MF A01 CSCL 05/5

Average contrast sensitivity functions were determined for six observers in the dark and under three colors of dim, ambient illumination. Measurements were taken with two different CRT screen brightnesses. The color of the illuminant did not affect the shape of these functions, or change sensitivity relative to a dark background. But the shape of the functions was changed by the screen luminance, consistent with other data in the literature. The frequent preference in submarine sonar shacks to blue light, over the customary red, is, therefore, due to factors other than enhanced contrast of the visual displays. GRA

N83-16045# Technion - Israel Inst. of Tech., Haifa. Center of Human Engineering and Industrial Safety Research.
ATTENTION CONTROL IN COMPLEX INFORMATION PROCESSING TASKS Final Report
Daniel Gopher and Gabriel Spitz Jul. 1982 26 p refs
(Grant AF-AFOSR-0069-82; AF Proj. 2313)
(AD-A120402; HEIS-8207; AFOSR-82-0845TR) Avail: NTIS HC A03/MF A01 CSCL 05/8

Results of this research can be summarized by starting that, under normal conditions, human operators are able to actively control their resource allocation. However, in the absence of feedback and proper instruction, the strategies which operators develop are often suboptimal. Moreover, time-sharing performance appears to be quite rigid and lacks the flexibility to respond efficiently to fluctuations in the requirements of the situation. Author (GRA)

N83-16046# National Academy of Sciences - National Research Council, Washington, D. C. Assembly of Mathematical and Physical Sciences.
AGING AND THE GEOCHEMICAL ENVIRONMENT
1981 154 p refs
(Contract DE-AT01-79EV-93015)
(DE82-001319; DOE/EV-93015/1) Avail: NTIS HC A08/MF A01

The aging process and related environmental aspects that provide useful insight toward postponing some of the inevitable effects of aging were assessed. The awareness of biomedical and geochemical research scientists, decision makers in related areas, and the lay public interested in an undertanding of the relation of the geochemical environment to senescence. DOE

N83-16047# Pennsylvania State Univ., University Park. Biomechanics Lab.

A MATHEMATICAL MODEL OF THE INERTIAL PROPERTIES OF A CARRIER-BACKPACK SYSTEM, VOLUME 4 Final Report, 1 Oct. 1979 - 31 Aug. 1981
Phillip E. Martin, Richard N. Hinrichs, In-Sik Shin, and Richard C. Nelson May 1982 84 p refs
(Contract DAAK60-79-C-0131; DA Proj. 1L1-62723-AH-98)
(AD-A120163; NATICK/TR-82/022-Vol-4; NATICK/IPL-252-Vol-4) Avail: NTIS HC A05/MF A01 CSCL 06/3

This is a report on the development of a mathematical model and FORTRAN program to examine the inertial properties of a human backpack system. A 12 segment model was formulated to represent a soldier carrying a backpack and other objects often carried during military operations. This computer model is often used to generate values of the following variables: system mass, system center of mass location, system inertia tensor, and principal moments of inertia for the system. The model can be used to simulate both a male and female human body. Any one of four backpack systems, each containing a 20 lb load, can be examined. Three of the backpacks have external frames and one has an internal frame. One or two loads, the weights of which are determined by the program user can be added to the 20 lb pack load. The positioning of these added loads is also user determined. In this report, the development of the model is discussed and results of executions of the program are presented. In addition, the report contains a listing of the FORTRAN program.
Author (GRA)

N83-16027*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LIFE SCIENCES EXPERIMENTS ON THE SPACE SHUTTLE
Richard D. Johnson *In its* Space Gerontology Nov. 1982 p 75-79
(For primary document see N83-16018 06-52)
Avail: NTIS HC A06/MF A01 CSCL 05H

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N83-16048*# Sperry Univac, St. Paul, Minn.
INVESTIGATION OF MULTILAYER MAGNETIC DOMAIN LATTICE FILE
E. J. Torok, M. Kamin, and C. H. Tolman Aug. 1982 160 p refs
(Contract NAS1-15007)
(NASA-CR-165908; NAS 1.26:165908) Avail: NTIS HC A08/MF A01 CSCL 09B

A theoretical and experimental investigation determined that current accessed self structured bubble memory devices have the potential of meeting projected data density and speed requirements. Device concepts analyzed include multilayer ferrimagnetic devices where the top layer contains a domain structure which defines the data location and the second contains the data. Current aperture and permalloy assisted current propagation devices were evaluated. Based on the result of this work more detailed device research was initiated. Detailed theoretical and experimental studies indicate that the difference in strip and threshold between a single bubble in the control layer and a double bubble which would exist in both the control layer and data layer is adequate to allow for detection of data. Detailed detector designs were investigated.
Author

N83-16049# California Univ., Berkeley. Computer Science Div.
PROGRAM PAGE REFERENCE PATTERNS
Robert S. Fabry and Robert B. Hagmann 15 Nov. 1981 11 p refs
(Contract N00039-82-C-0235; ARPA Order 4031)
(AD-A120854) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper describes a set of measurements of the memory reference patterns of some programs. The technique used to obtain these measurements is unusually efficient. The data is presented in graphical form to allow the reader to see how the program uses memory. Constant use of a page and sequential access of memory are easily observed. An attempt is made to classify the programs based on their referencing behavior. From this analysis it is hoped that the reader will gain some insights as to the effectiveness of various memory management policies.
Author (GRA)

N83-16050# Yale Univ., New Haven, Conn. Dept. of Computer Science.
IMPOSSIBILITY OF DISTRIBUTED CONSENSUS WITH ONE FAULT PROCESS
Michael J. Fischer, Nancy A. Lynch, and Michael S. Paterson Sep. 1982 15 p refs
(Contracts N00014-82-K-0154; DAAG29-79-C-0155; Grants NSF MCS-79-24370; NSF MCS-81-16678)
(AD-A120161; RR-245) Avail: NTIS HC A02/MF A01 CSCL 09/2

The consensus problem involves an asynchronous system of processes, some of which may be unreliable. The problem is for the reliable processes to agree on a binary value. We show that every protocol for this problem has the possibility of nontermination, even with only one faulty process. By way of contrast, solutions are known for the synchronous case, the 'Byzantine Generals' problem.
GRA

N83-16051# TRW Defense and Space Systems Group, Redondo Beach, Calif.
THE LSI APPLICATIONS Final Technical Report, Jun. 1980 - Jun. 1982
Griffiss AFB, N.Y. RADC Jul. 1982 88 p refs
(Contract F30602-80-C-0150; AF Proj. 3202)
(AD-A120502; TRW-35735-6013-UT-00; RADC-TR-82-201) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report deals with the task of achieving an order of magnitude increase in execution speed of a set of computation-bound processes. This increase was achieved by augmenting the host processor with a peripheral microprogrammed device. Both of these machines were emulated in a hardware description language. The peripheral device is composed of three major units: Microprogrammed Control Unit (MCU), Arithmetic Processing Unit (APU), and Interface Control Unit (ICU). The structure and function of these individual units is examined in greater detail.
GRA

N83-16052# Brookhaven National Lab., Upton, N. Y.
THE MINI- AND MICRO-PROCESSORS AND FASTBUS IN THE EXPERIMENTAL PROGRAM AT BROOKHAVEN NATIONAL LABORATORY
L. B. Leipuner 17 Sep. 1981 7 p refs Presented at Conf. on the Appl. of Microprocessors to High Energy Phys. Expt., Geneva, 4 May 1981
(Contract DE-AC02-76CH-00016)

(DE82-001811; BNL-30119; CONF-810539-9) Avail: NTIS HC A02/MF A01

The use of small processors in an experimental program is reviewed. A data acquisition system (FASTBUS), is also reviewed. DOE

N83-16053# Los Alamos Scientific Lab., N. Mex.
EXISTING COMPUTER APPLICATIONS, MAINTAIN OR REDESIGN: HOW TO DECIDE
L. Brice 1981 19 p refs Presented at the 12th CMG Intern. Conf. of Computer Performance Evaluation Existing Computer Appl., New Orleans, 12 Dec. 1981
(Contract W-7405-eng-36)
(DE81-025314; LA-UR-81-1825; CONF-811202-1) Avail: NTIS HC A02/MF A01

Maintenance of large applications programs is an aspect of performance management that has been largely ignored by those studies that attempt to ring structure to the software production environment. Maintenance in this paper means: fixing bugs, modifying current design features, adding enhancements, and porting applications to other computer systems. It is often difficult to decide whether to maintain or redesign. One reason for the difficulty is that good models and methods do not exist for differentiating between those programs that should be maintained and those that should be redesigned. This enigma is illustrated by the description of a large application was monitored for maintenance effort, thereby providing some insight into the redesign/maintain decision. Those tools which currently exist for the collection and measurement of performance data are highlighted. DOE

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N83-16054*# Cornell Univ., Ithaca, N. Y. School of Electrical Engineering.
THE LANGUAGE PARALLEL PASCAL AND OTHER ASPECTS OF THE MASSIVELY PARALLEL PROCESSOR Final Report, Jan. 1980 - Dec. 1982
Anthony P. Reeves and John D. Bruner (California Univ., Lawrence Livermore Lab.) [1982] 255 p refs Prepared in cooperation with Purdue Univ.
(Grant NAG5-3)
(NASA-CR-169719; NAS 1.26:169719) Avail: NTIS HC A12/MF A01 CSCL 09B

A high level language for the Massively Parallel Processor (MPP) was designed. This language, called Parallel Pascal, is described in detail. A description of the language design, a description of the intermediate language, Parallel P-Code, and details for the MPP implementation are included. Formal descriptions of Parallel Pascal and Parallel P-Code are given. A compiler was developed which converts programs in Parallel Pascal into the intermediate Parallel P-Code language. The code generator to complete the compiler for the MPP is being developed independently. A Parallel Pascal to Pascal translator was also developed. The architecture design for a VLSI version of the MPP was completed with a description of fault tolerant interconnection networks. The memory arrangement aspects of the MPP are discussed and a survey of other high level languages is given. Author

N83-16055# Army Missile Command, Redstone Arsenal, Ala.
FORTH AND THE IEEE-488 BUS
K. B. Farr and J. G. Duthie 2 Jul. 1982 20 p
(AD-A119976; AD-E950296; DRSMI/RR-82-9-TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report demonstrates the natural marriage of the IEEE-488 bus to microcomputers using FORTH in a laboratory situation. Author (GRA)

N83-16056# Naval Postgraduate School, Monterey, Calif.
A SIMPLE, NATURAL NOTATION FOR APPLICATIVE LANGUAGES
Bruce J. MacLennan Sep. 1982 16 p
(RR0000110)
(AD-A120700; NPS52-82-009) Avail: NTIS HC A02/MF A01 CSCL 09/2

Many non-specialists are intimidated by the mathematical appearance of most applicative, functional, and very-high-level languages. This report presents a simple notation that has an unintimidating, natural-language appearance and that can be adapted to a variety of languages. The paper demonstrates its use as an alternate syntax for LISP, PROLOG, Backus' FP, relational programming, and relational database retrievals. The grammar's eight productions can be handled by a simple recursive-descent parser. Author (GRA)

N83-16057# California Univ., Berkeley. Computer Graphics Lab.
THE GRAPHICAL CURVE EDITOR (GRACE) Status Report
Anthony D. Rose 28 Sep. 1982 14 p refs
(Contract N00039-82-C-0235)
(AD-A120664) Avail: NTIS HC A02/MF A01 CSCL 09/2

This document describes a program called Grace, an interactive tool for creating two-dimensional pictures. The program consists of two communicating parts: first, a data flow network running on an Evans and Sutherland Picture System 300 (PS300), and second, a C program running on a host VAX 11/780. Scenes are created by creating and/or modifying any number of objects. Once a scene is created it may be saved for later editing, or sent to a hardcopy device for permanent imaging. Object types currently supported are text, vector lists, rectangles and a new curve type; the Beta-spline (circles are scheduled for the next release). Once an object is defined it may be transformed by translating, rotating or scaling it (only translation is currently implemented). These transformations are all performed in real time, thanks to the graphics display processor contained within the PS300. GRA

N83-16058# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
DPL-82: A LANGUAGE FOR DISTRIBUTED PROCESSING
Lars Warren Ericson 26 Jul. 1982 18 p refs
(Contract F33615-78-C-1551; ARPA Order 3597)
(AD-A120122; CMU-CS-82-129) Avail: NTIS HC A02/MF A01 CSCL 09/2

DPL-82 is a language for composing programs of concurrently-executing processes. Processes may be all on a single machine or may be distributed over a set of processors connected to a network. The semantics of the language is derived from the underlying interprocess communication facility (IPC) and from the dataflow model of computation. This paper discusses the major concepts of the language, namely nodes, arcs, connections, tokens, signals, and activations, and presents examples which illustrate the construction of distributed programs in DPL-82 with internal arcs, external arcs, and child arcs. Features for process-to-process mapping and dead process restart are mentioned. The paper concludes with some ideas for future research. GRA

N83-16059# Naval Ship Research and Development Center, Bethesda, Md.
GPRIME: A GEOMETRIC LANGUAGE FOR FINITE ELEMENT MODELING PROGRAM MANUAL Final Report
James M. McKee, Michael E. Golden, and Dolores R. Wallace Sep. 1982 125 p refs
(SF43411391)
(AD-A119923; DTNSRDC-82/062) Avail: NTIS HC A06/MF A01 CSCL 09/2

The GPRIME geometric language is a computer language for describing and manipulating a wide variety of geometric shapes. The GPRIME language processor is a computer program that translates the geometric language description into a set of consistent mathematical definitions using B-spline approximation techniques. GPRIME application programs are computer programs,

such as finite element data generators, that make use of the mathematical definitions created by the language processor. This manual is intended for new and experienced users. It describes the GPRIME geometric language, the GPRIME language processor, and recommended procedures for geometric modeling with GPRIME. With the GPRIME language it is simple to create mathematical models of complex geometry. Classical shapes are defined using straight-forward expressions, and more general curves and surfaces can be defined using digitized coordinate data. The GPRIME processor uses interactive computer graphics for defining geometry and for aiding in visualizing the model being created. The processor creates a geometric data base which may be used for restarting the definition process at later sessions. The GPRIME language was designed for use in creating finite element structural analysis models but can be applied wherever a description of geometry is required. This manual defines the form and syntax of the GPRIME language and its command structure. GRA

N83-16060# Naval Research Lab., Washington, D. C.
A FORTRAN BASED PROGRAM FOR COMPUTERIZED ALGEBRAIC MANIPULATION Final Report
R. R. Dasenbrock 21 Sep. 1982 74 p refs
(AD-A119958; NRL-8611) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes a program which can perform literal algebraic manipulation on a high speed electronic computer. Emphasis is concentrated on the manipulation of the harmonic series occurring in the classical theory of lightly perturbed dynamical systems. The program is written in FORTRAN compiler and at least a 32 bit word length. GRA

N83-16061*# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ROBUSTNESS OF ADAPTIVE CONTROL ALGORITHMS IN THE PRESENCE OF UNMODELED DYNAMICS
Charles E. Rohrs, Lena Valavani, Michael Athans, and Gunter Stein Sep. 1982 11 p refs Presented at the 21st IEEE Conf. on Decision and Control, Orlando, Fla., Dec. 1982
(Grant NGL-22-009-124; Contract N00014-82-K-0582; Grant AF-AFOSR-3281-77; NR Proj. 606-003)
(NASA-CR-169643; NAS 1.26:169643; AD-A119910; LIDS-P-1240) Avail: NTIS HC A02/MF A01 CSCL 12A

This paper reports the outcome of an exhaustive analytical and numerical investigation of stability and robustness properties of a wide class of adaptive control algorithms in the presence of unmodeled dynamics and output disturbances. The class of adaptive algorithms considered are those commonly referred to as model-reference adaptive control algorithms, self-tuning controllers, and dead-beat adaptive controllers; they have been developed for both continuous-time systems and discrete-time systems. The existing adaptive control algorithms have been proven to be globally asymptotically stable under certain assumptions, the key ones being (1) that the number of poles and zeroes of the unknown plant are known, and (2) that the primary performance criterion is related to good command following. These theoretical assumptions are too restrictive from an engineering point of view. Real plants always contain unmodeled high-frequency dynamics and small delays, and hence no upper bound on the number of the plant poles and zeroes exists. Also real plants are always subject to unmeasurable output additive disturbances, although these may be guide small. Hence, it is important to critically examine the stability robustness properties of the existing adaptive algorithms when some of the theoretical assumptions are removed; in particular, their stability and performance properties in the presence of unmodeled dynamics and output disturbances. GRA

N83-16062# Cincinnati Univ., Ohio. Inst. of Applied Interdisciplinary Research.
USER'S MANUAL FOR UCIN-EULER. A MULTIPURPOSE, MULTIBODY SYSTEMS DYNAMICS COMPUTER PROGRAM Technical Report, 1 Jul. 1977 - 1 Sep. 1982
Ronald L. Huston, Mark W. Harlow, and Nancy L. Gausewitz Sep. 1982 52 p refs
(Contract N00014-76C-0138; Grants NSF ENG-75-21037; NSF MEA-81-01110)
(AD-A120403; ONR-UC-MIE-090182-14) Avail: NTIS HC A04/MF A01 CSCL 09/2

This is a User's Manual for the computer program UCIN-EULER. The program is designed and developed to study the dynamics of multibody systems. The multibody systems encompassed by EULER are systems of linked rigid bodies with no closed loops, such as robot arms, chains, antennas, manipulators, and human body models. The manual provides instruction for using EULER to study multibody system dynamics. It also provides sample input and output data. Input procedures and commands are expressed in terms of keywords in order to make the program useful and readily accessible to even the casual user. Author (GRA)

N83-16063# Systems Architects, Inc., Randolph, Mass.
COMPUTER SYSTEMS ACQUISITION METRICS HANDBOOK. VOLUME 3. DATA ELEMENT DICTIONARY
May 1982 149 p 4 Vol.
(Contract F19628-80-C-0207)
(AD-A120377; ESD-TR-82-143(3)) Avail: NTIS HC A07/MF A01 CSCL 05/2

The Data Element Dictionary is a reference guide for all the data elements. It lists the name, index number, life cycle phase description, an example with explanations and Worksheet reference for each data element. Author (GRA)

N83-16064# Systems Architects, Inc., Randolph, Mass.
COMPUTER SYSTEMS ACQUISITION METRICS HANDBOOK. VOLUME 4. THEORETICAL SUPPLEMENT
May 1982 75 p refs 4 Vol.
(Contract F19628-80-C-0207)
(AD-A120378; ESD-TR-82-143(4)) Avail: NTIS HC A04/MF A01 CSCL 09/2

This volume documents the background research and describes the various metrics approaches that were analyzed. It goes on to describe the methodology selected and defines the framework for the handbook. Author (GRA)

N83-16065# Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, Md.
INTERACTIVE GRAPHICS PLOTTING SYSTEM (IGPS)
Bradley M. Lufkin Sep. 1982 79 p ref
(AD-A120417; AMSAA-TR-368) Avail: NTIS HC A05/MF A01 CSCL 09/2

IGPS (Interactive Graphics Plotting System) is a computer-graphics program which produces high-quality plots of two-dimensional data; it is written in BASIC for the Tektronix 4051 desk-top computer. IGPS features: A large variety of axis systems, including probability paper for several distributions, logarithmic paper, and user-definable paper; neat tick mark and axis labeling with automatic or user-controlled decimal-point selection; several curve marker and dashed line types; legends; curve fitting; plotting of user-defined functions; data storage and retrieval on all Tektronix 4051 peripherals; and storage and retrieval of entire plots. Author (GRA)

N83-16066# Naval Postgraduate School, Monterey, Calif. Dept. of Administrative Sciences.
SOFTWARE ENGINEERING BASICS: A PRIMER FOR THE PROJECT MANAGER M.S. Thesis
Steven Patrick Artzer and Richard Alvin Neidrauer Jun. 1982 280 p refs
(AD-A120423) Avail: NTIS HC A13/MF A01 CSCL 09/2

A key to any software development project is the presence of technically proficient management. The discipline of software Engineering offers many different tools and techniques to aid the project manager in the development of quality software. This thesis provides an overview of this discipline, including its goals and underlying theoretical concepts. A discussion of specific tools and techniques that are applicable throughout the life cycle is included. Recognizing that the maintainability of the software is a primary

consideration of any development project, two methods of measuring software for this important attribute are examined. Among the conclusions is that there exists a need for further research necessary in order to validate the utility of the tools and techniques of Software Engineering in large scale applications.
Author (GRA)

N83-16067# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
DESKTOP COMPUTER VERSION OF ASENT
R. W. Ashcraft Nov. 1981 24 p refs
(Contract DE-AC04-76DP-00487)
(DE82-002956; MHSMP-81-46) Avail: NTIS HC A02/MF A01
The ASENT, a CDC6600 FORTRAN program was converted to the HP9845T system. The new version is written in HP enhanced BASIC and offers graphical output in addition to the standard printout. A program listing and sampling data case are included. DOE

N83-16068# Science Research Council, Chilton (England). Neutron Div.
FAST FOURIER TRANSFORM PROGRAM FOR THE DECONVOLUTION OF IN10 DATA
W. S. Howells Apr. 1981 19 p refs
(RL-81-039) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries
A deconvolution program based on the Fast Fourier Transform technique is described and some examples are presented to help users run the programs and interpret the results. Instructions are given for running the program on the RAL IBM 360/195 computer. DOE

N83-16069# Oak Ridge National Lab., Tenn. Fusion Energy Div.
NEW DEVELOPMENTS IN PROGRAM STANSOL VERSION 3
W. H. Gray Oct. 1981 4 p refs Presented at the 9th Symp. on Eng. Probl. of Fusion Res., Chicago, 26-29 Oct. 1981
(Contract W-7405-eng-26)
(DE82-002917; CONF-811040-92) Avail: NTIS HC A02/MF A01
STANSOL is a computer program that applied a solution for the mechanical displacement, stress, and strain in rotatonally-transversely isotropic, homogeneous, axisymmetric solenoids. Careful application of the solution permits the complex mechanical behavior of multilayered, nonhomogeneous solenoids to be examined in which the loads may vary arbitrarily from layer to layer. Loads applied to the solenoid model by program STANSOL may consist of differential temperature, winding preload, internal and/or external surface pressure, and electromagnetic Lorentz body forces. STANSOL version 3, the latest update to the original version of the computer program, also permits structural analysis of solenoid magnets in which frictionless interlayer gaps may open or close. The new theory coded into version 3 of the STANSOL program is presented, as well as the new input data format and graphical output display of the resulting analysis. DOE

N83-15294# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
STATUS OF COMPUTER SIMULATIONS OF USAF AIRCRAFT AND AN ALTERNATIVE SIMULATION TECHNIQUE
Anthony G. Gerardi and Levon Minnetyan (Clarkson Coll.) *In* AGARD Aircraft Dyn. Response to Damaged and Repaired Runways Aug. 1982 10 p (For primary document see N83-15284 06-05)
Avail: NTIS HC A10/MF A01

N83-15896# Argonne National Lab., Ill.
SOFTWARE FOR COMPARISON AND OPTIMIZATION OF POWER SYSTEMS Final Report
Greg Berry *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 14 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N83-16070# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
REAL TIME STATUS MONITORING FOR DISTRIBUTED SYSTEMS Final Report, Jan. 1981 - Aug. 1982
Zary Segall, Ajay Singh, Richard Snodgrass, Anita K. Jones, and Daniel P. Siewiorek 27 Aug. 1982 197 p refs
(Contract DASG60-80-C-0057)
(AD-A120056) Avail: NTIS HC A09/MF A01 CSCL 09/2
Work on the monitor has concentrated on three aspects: furthering the conceptual design, implementing the lower level mechanisms of the monitor and designing and implementing the relational monitor. At this point, we have a fairly complete idea of the tasks the various components perform and how these components will interact. The components are: StarMon, low level data collection under the StarOS operating system on CM*, consisting of two processes: Accountant, interfaces to the Simon Accountant via the EtherNet; MonProc, performs name translation, enabling of events and miscellaneous services. Medic, low level collection under the Medusa operating system on CM*, Simon Accountant interfaces with the resident monitor (either StarMon or Medic) using a system-independent protocol; Simon, the computing engine for deriving high level information from event records; Control, accepts queries from the user in a declarative language and translates these queries into update networks for Simon. At this point, the first three components are nearing completion. Once their condition is stable, sensors will be placed throughout both StarOS and Medusa to provide a source of event records for Simon. The structure of Simon has been partially designed and is in the early stages of implementation. Also the Sensor Definition facility has been designed and implemented.
GRA

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N83-16071# Yale Univ., New Haven, Conn. Center for Systems Science.
STABLE HYBRID ADAPTIVE CONTROL
Kumpati S. Narendra and Iraky H. Khalifa Jul. 1982 27 p refs (Contract N00014-76-C-0017)
(AD-A120655; Rept-8206) Avail: NTIS HC A03/MF A01 CSCL 09/2
The paper deals with hybrid adaptive control of single-input single-output linear dynamical systems with unknown parameters. The system operates in continuous time while control parameters updated only at discrete instants. Using a hybrid error model it is shown that adaptive algorithms used in discrete and continuous systems can be directly extended to hybrid systems. The resulting nonlinear time-varying systems are globally stable and independent of the frequency with which the parameters are adjusted. GRA

N83-16072*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPLICATION OF MATRIX SINGULAR VALUE PROPERTIES FOR EVALUATING GAIN AND PHASE MARGINS OF MULTI-LOOP SYSTEMS
V. Mukhopadhyay (George Washington Univ.) and J. R. Newsom Jul. 1982 11 p refs Presented at the AIAA Guidance and Control Conf., San Diego, Calif., 9-11 Aug. 1982 Previously announced in IAA as A83-12457
(NASA-TM-84524; NAS 1.15:84524) Avail: NTIS HC A02/MF A01 CSCL 09B
For Abstract see A83-12457 (or A83-12457/2).

N83-16073# Yale Univ., New Haven, Conn. Center for Systems Science.
ERROR MODELS FOR STABLE HYBRID ADAPTIVE SYSTEMS, PART 2
Kumpati S. Narendra, Iraky H. Khalifa, and Anuradha M. Annaswamy Aug. 1982 29 p refs
(Contract N00014-76-C-0017)
(AD-A120652; REPT-8207-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 09/2

The paper presents a unified approach to the design of stable adaptive algorithms for hybrid, discrete and continuous systems which have two time scales. Hybrid error models are first analyzed in detail using two distinct approaches and the results are extended to discrete systems in which the parameters are adjusted at rates slower than those at which the systems operate. The algorithms developed when applied to the adaptive control problem are shown to result in global stability. Simulation results are included and reveal the dependence of the convergence rates of the various algorithms on the two time-scales. GRA

N83-16074# Yale Univ., New Haven, Conn. Center for System Science.
ERROR MODELS FOR STABLE HYBRID ADAPTIVE CONTROL
Kumpati S. Narendra and Iraky H. Khalifa Jun. 1982 10 p refs
(Contract N00014-76-C-0017)
(AD-A120653; Rept-8204) Avail: NTIS HC A02/MF A01 CSCL 09/2

The main objective of this brief report is to analyze the asymptotic behavior of three error models which arise in the identification and control of hybrid adaptive systems. Using methods developed in 1 and 3 this analysis can be applied directly to establish the global stability of hybrid model reference adaptive systems. These results as well as the design considerations which arise in such problems will be contained in a forthcoming paper. GRA

N83-16075# Yale Univ., New Haven, Conn. Center for Systems Science.
A GLOBALLY STABLE ADAPTIVE CONTROLLER FOR MULTIVARIABLE SYSTEMS
R. P. Singh and K. S. Narendra Apr. 1982 35 p refs
(Contract N00014-76-C-0017)
(AD-A120654; Rept-8111) Avail: NTIS HC A03/MF A01 CSCL 09/2

Hermite normal forms of nonsingular transfer matrices play a central role in determining the class of model transfer matrices which the plant can follow. However, due to inherent complexity in specifying the Hermite form in general, it has been argued that adaptive control is practically feasible only for those plants which have diagonal Hermite forms, i.e., which can be decoupled by using state feedback only. The sign definiteness of the high frequency gain matrix KP has been found to be sufficient to generate stable adaptive laws. For 2x2 systems, the knowledge of relative degree of each scalar transfer function has been used in determining the Hermite form. A globally stable adaptive controller has been developed and it has been shown that all 2x2 stably invertible systems can be generically adaptively controlled subject to the definiteness condition on the gain matrix. GRA

N83-16076# Yale Univ., New Haven, Conn. Center for Systems Science.
THE CONTROLLABILITY OF BILINEAR SYSTEMS. PART 1: COMPLETE CONTROLLABILITY HOMOGENEOUS SYSTEMS IN R2-(0)
Daniel E. Koditschek and Kumpati S. Narendra Aug. 1982 28 p refs
(Contract N00014-76-C-0017)
(AD-A120736; Rept-8208-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report may be seen as a part of a continuing effort to address some typical problems of nonlinear control, initially in settings simple enough to permit complete solutions based upon algebraic statements involving system parameters. It is felt that much more effort of this nature will be required before the fruit of theoretical work in nonlinear control theory becomes useful or even accessible for application in practical situations. This report is organized as follows. A preliminary discussion of techniques and terminology is given in section 2. The question of complete controllability is resolved in section 3. In section 4 we consider a variety of related controllability concepts. Future reports will concern the nature of reachable sets when controllability fails, as well as similar results for general bilinear systems on the plane. GRA

N83-16077# Wright State Univ., Dayton, Ohio. Dept. of Engineering.
DIGITAL REDESIGN OF EXISTING MULTILOOP CONTINUOUS CONTROL SYSTEMS VIA CONTINUOUS FREQUENCY MATCHING Final Report, 1 May 1981 - 1 Jun. 1982
Kuldip S. Rattan Sep. 1982 52 p refs
(Grant AF-AFOSR-0132-81; AF Proj. 2304)
(AD-A120421; AFOSR-82-0915TR) Avail: NTIS HC A04/MF A01 CSCL 09/2

The problem of converting existing multiloop continuous control systems into digital control systems is considered. The objective of this paper is to develop a computer-aided method for synthesizing the pulse-transfer function of the digital controllers. This is done by matching the continuous frequency responses of the digital control system to those of a continuous system with a minimum weighted mean square error. Formulas for computing the parameters of digital controllers are obtained as a result. An example of digitalizing the existing continuous flight controller for the longitudinal YF-16 aircraft is considered and the results are compared with those obtained by previous methods. Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N83-16078# Stanford Univ., Calif. Dept. of Computer Science.
COMBINATORIAL ALGORITHMS 1
Ernst W. Mayr May 1982 96 p refs
(Contract N00014-81-K-0330; Grant NSF MCS-77-23738)
(AD-A119438; SU-STAN-CS-82-907) Avail: NTIS HC A05/MF A01 CSCL 12/1

Combinational algorithms are discussed. Machine models are also discussed. Author (GRA)

N83-16079# Pittsburgh Univ., Inst. for Computational Mathematics and Applications.
A MATHEMATICAL MODEL FOR THE VERIFICATION OF SYSTOLIC NETWORKS
Rami G. Melhem and Werner C. Rheinboldt Oct. 1982 62 p refs
(Contract N00014-80-C-0455; Grant AF-AFOSR-0176-80)
(AD-A120698; ICMA-82-47) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper presents a mathematical model for systolic architectures for use in the verification of the operation of certain systolic networks. The I/O description of the global effect of the computations performed by the network are obtained by solving a particular system of difference equations. The verification technique is applied to four different systolic networks proposed in the literature. Author (GRA)

N83-16080# Yale Univ., New Haven, Conn. Dept. of Computer Science.
A NOTE ON THE GENERALIZED CONJUGATE GRADIENT METHOD
Stanley C. Eisenstat Mar. 1982 8 p refs
(Contract N00014-76-C-0277; Grant NSF MCS-81-04874)
(AD-A120117; RR-228) Avail: NTIS HC A02/MF A01 CSCL 12/1

Each iterate generated by the Generalized Conjugate Gradient

Method of Concus and Golub and Widlund is shown to be the best approximation to the solution from a certain affine subspace (although not form the natural affine Krylov subspace). This property is used to improve the error bounds given by Widlund and Hageman, Luk, and Young. Author (GRA)

N83-16081# Pittsburgh Univ., Inst. for Computational Mathematics and Applications.
ON THE DISCRETIZATION ERROR OF PARAMETIZED NONLINEAR EQUATIONS
James P. Fink and Werner C. Rheinboldt 1982 36 p refs
(Contract N00014-80-C-0455; Grants AF-AFOSR-0176-80; NSF MCS-76-05299)
(AD-A120108; ICMA-82-40) Avail: NTIS HC A03/MF A01 CSCL 12/1

Many applications lead to nonlinear, parameter dependent equations H(y,t) = y sub o, where H: Y x T yields Y, y sub o epsilon rge H, and the state space Y is infinite-dimensional while the parameter space T has finite dimension. The case dim T = 1 is of special interest in connection with continuation methods. For this case, a general theory is developed which provides for the existence of solution paths of a rather general class of such equations and of their finite-dimensional approximations, and which allows for an assessment of the error between these paths. A principal tool in this analysis is the theory of nonlinear Fredholm operators. The results cover a more general class of operators than the mildly nonlinear mappings to which other approaches appear to be restricted. GRA

N83-16082# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
A SIMPLIFICATION OF LENTZ'S ALGORITHM Final Report
W. J. Lentz Aug. 1982 18 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A120107; ERADCOM/ASL-TR-0118) Avail: NTIS HC A02/MF A01 CSCL 12/1

The Lentz algorithm is a method of computing the continued fraction representation of functions. It was originally developed to calculate spherical Bessel functions in Mie scattering calculations. A simplification of the algorithm improvement is presented for the case in which a given term is exactly zero. A FORTRAN 4 program is presented which calculates three test cases correctly when the numerator or denominator terms are exactly zero. GRA

N83-16083# North Carolina Univ., Chapel Hill. Dept. of Statistics.
EXTREMES AND LOCAL DEPENDENCE IN STATIONARY SEQUENCES
M. R. Leadbetter Jun. 1982 27 p refs
(Contract F49620-82-C-0009)
(AD-A120180; TR-12; AFOSR-82-0862TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Extensions of classical extreme value theory to applied to stationary sequences generally make use of two types of dependence restriction: (1) a weak mixing condition restricting long range dependence; and (2) a local condition restricting the clustering of high level exceedances. The purpose of this paper is to investigate extremal properties when the local condition (3) is omitted. It is found that, under general conditions, the type of the limiting distribution for maxima is unaltered. The precise modifications and degree of clustering of high level exceedances are found to be largely described by a parameter here called the extremal index of the sequence. Author (GRA)

N83-16084# Naval Underwater Systems Center, New London, Conn.
APPROXIMATIONS TO SOME GENERALIZED FUNCTIONS: APPLICATIONS TO ARRAY PROCESSING
Albert H. Nuttall 19 Jul. 1982 47 p refs
(AD-A120170; NUSC-TR-6767) Avail: NTIS HC A03/MF A01 CSCL 12/1

Approximations to some generalized functions generated by the process of differentiation are developed and used to interpret some integrals involving generalized functions. Application to the realization of the ideal voltage response pattern of an array is made and illustrated for both an impulsive and a smooth approximation to the required generalized weighted function. Author (GRA)

N83-16085# Ohio State Univ., Columbus. Dept. of Statistics.
PROBLEMS OF STATISTICAL INFERENCE AND OPTIMIZATION WITH APPLICATIONS Final Report, 1 Jul. 1978 - 30 Sep. 1981
J. S. Rustagi 8 Feb. 1982 7 p refs
(Contract N00014-78-C-0543; NR Proj. 042-403)
(AD-A120151; OSURF-12) Avail: NTIS HC A02/MF A01 CSCL 12/1

Research was initiated in the areas of regression models for grouped data and optimization techniques in statistics. The results obtained were communicated through interim technical reports and publications in journals. The list of such publications is given. GRA

N83-16086# Washington State Univ., Pullman. Dept. of Computer Science.
THREE-DIMENSIONAL DIGITAL PLANES
Chul E. Kim College Park, Md. Maryland Univ. Jul. 1982 39 p
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A120118; TR-1190; AFOSR-82-0871TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

Definitions of 3D digital surface and plane are introduced. Many geometric properties of these objects are examined. In particular, it is shown that digital convexity is neither a necessary nor a sufficient condition for a digital surface element to be a convex digital plane element, but it is both necessary and sufficient for a digital surface to be a digital plane. Also, algorithms are presented to determine whether or not a finite set of digital points is a (convex) digital plane element. GRA

N83-16087# McGill Univ., Montreal (Quebec).
A REVIEW AND SOME EXTENSIONS OF TAKEMURA'S GENERALIZATIONS OF COCHRANS' THEOREM
George P. J. Styan Sep. 1982 33 p refs
(Contracts N00014-75-C-0442; DAAG29-82-K-0156; NR Proj. 042-034)
(AD-A120647; TR-56; TR-2; ARO-19065.4-MA) Avail: NTIS HC A03/MF A01 CSCL 12/1

Generalizations of Cochran's theorem by Takemura are discussed in connection with results by Anderson and Styan and other works by Rao and Yanai and Marsaglia and Styan. A number of further extensions are presented. GRA

N83-16088# Stanford Univ., Calif. Dept. of Statistics.
THE MOMENTS AND DISTRIBUTIONS OF SOME QUANTITIES ARISING FROM RANDOM ARCS ON THE CIRCLE
Fred Huffer 28 Sep. 1982 92 p refs
(Contract N00014-76-C-0475)
(AD-A120660; TR-326) Avail: NTIS HC A05/MF A01 CSCL 12/1

This work concerns random arcs on the circle. Arcs with randomly chosen lengths are placed uniformly on the circumference of a circle and probabilistic questions are asked about the resulting configuration. Emphasis is placed on deriving expressions for the moments and joint moments of quantities such as the number of uncovered gaps, the measure of the uncovered region and the length of the largest gap. Distributions are also obtained for some of these variables. GRA

N83-16089# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
RESEARCH ON OPTIMIZATION ALGORITHMS Final Report, 1 Sep. 1978 - 31 Aug. 1982
Katta G. Murty Sep. 1982 13 p refs
(Grant AF-AFOSR-3646-78; AF Proj. 2304)
(AD-A120748; AFOSR-82-0888TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This is a summary of research carried out under this grant. Some of the results are: for linear complementarity problems,

existing pivot algorithms like Lemke's complementary pivot method, Murty's principal pivoting method, Cottle-Dantzig principal pivoting method, Vander Heyden's variable dimension algorithm, are all exponential growth algorithms in the worst case even on very nice classes f problems. Polynomially bounded ellipsoid methods have been developed for solving convex quadratic programs or linear complementarity problems associated with positive semi-definite matrices. A practically efficient critical index algorithm based on orthogonal projections has been developed for linear complementarity problems associated with positive definite symmetric matrices. Efficient blossom algorithms have been developed for edge covering problems and 1-matching/covering problems in undirected networks, as well as efficient subroutines for performing various types of sensitivity analysis. A computer package for 1-matching/covering algorithms suitable for large scale applications has been developed. A bounding strategy for the set covering problem based on the 1-matching/covering problem and Lagrangean relaxation has been developed. Efficient linear time algorithms have been developed for checking the adjacency of two given 1-matching/covering incidence vectors on the 1-matching/covering polytope. GRA

N83-16090# Yale Univ., New Haven, Conn. Center for Systems Science.
LIMIT CYCLES OF PLANAR QUADRATIC DIFFERENTIAL EQUATIONS
Daniel E. Koditschek and Kumpati S. Narendra May 1982 18 p refs
(Contract N00014-76-C-0017)
(AD-A120710; Rept-8110) Avail: NTIS HC A02/MF A01 CSCL 12/1

Since Hilbert posed the problem of systematically counting and locating the limit cycles of polynomial systems on the plane in 1900, much effort has been expended in its investigation. A large body of literature, chiefly by Chinese and Soviet authors, has addressed this question in the context of differential equations whose field is specified by quadratic polynomials. This paper considers the class of quadratic differential equations which admit a unique equilibrium state, and establish sufficient conditions for the existence and uniqueness of limit cycles. The work is based upon insights and techniques developed in an earlier analysis of such systems motivated by questions from mathematical control theory. GRA

N83-16091# Stanford Univ., Calif. Dept. of Statistics.
SEQUENTIAL STOCHASTIC CONSTRUCTION OF RANDOM POLYGONS
Edward Ian George 10 Jun. 1982 142 p refs Also announced as N82-13812
(Contract N00014-76-C-0475)
(AD-A119410; TR-320) Avail: NTIS HC A07/MF A01 CSCL 12/1

Homogeneous Poisson fields of lines divide the plane into non-overlapping convex polygons. Of interest to researchers is geometrical probability have been the distributions of characteristics of the polygons induced by the distributions of the lines, especially N, the number of sides, S, the perimeter, and A, the area. A sequential stochastic process is developed from which an independent and identically distributed sample of polygons can be extracted with a stopping time. It is shown that the distribution of polygons so obtained is identical to the distribution of polygons in the Poisson field. The stochastic process is developed in full generality and can be applied to aniostropic cases as well as the case of most interest, the isotropic case. Useful families of anisotropic distributions for this problem are defined. The sequential stochastic process is used to derive general analytical expressions for polygon distributions for the investigation of the unkown distributions of N, S and A. Methods are also developed which provide the basis for very fast computer simulation of the process. A Monte Carlo study of distributions of N, S and A in various cases is presented. In particular, a sample of 2,500,000 polygons in the isotropic case provides the most precise results to date.
Author (GRA)

N83-16092# Institute of Nuclear Physics, Krakow (Poland).
SOLUTION OF THERMAL NEUTRON DIFFUSION EQUATION FOR THE 2-COMPONENT SYSTEM BY PERTURBATION CALCULATION
Urszula Woznicka Jan. 1981 37 p refs Submitted for publication
(INP-1125-AP) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

A method of solving the diffusion equation for the thermal neutron flux in a heterogeneous medium is presented. Perturbation calculation is successfully applied for the cylindrical concentric system after testing this method for the spherical concentric geometry analytically solved by Czubek. The method permits to calculate the thermal neutron decay constant and the space distribution of the thermal neutron flux in a heterogeneous geometry. The condition of the constant value of the neutron flux in the inner part of the system has to be met. This method has an application in the measurement of thermal neutron absorption cross sections. DOE

N83-16093# Sandia Labs., Albuquerque, N. Mex. Computational Physics Div.
NUMERICAL IMPLEMENTATION OF INELASTIC TIME-DEPENDENT AND TIME-INDEPENDENT, FINITE-STRAIN CONSTITUTIVE EQUATIONS IN STRUCTURAL MECHANICS
Samuel W. Key and Raymond D. Krieg 1981 23 p refs Presented at the Conf. on FENOMECH '81, Stuttgart, 25 Aug. 1981
(Contract DE-AC04-76DP-00789)
(DE82-004131; SAND-81-2192C; CONF-810896-1) Avail: NTIS HC A02/MF A01

A number of complex issues are resolved in a way that allows the incorporation of finite strain, inelastic material behavior into the piecewise numerical construction of solutions in solid mechanics. Without recourse to extensive continuum mechanics preliminaries, an elementary time independent plasticity model, an elementary time dependent creep model, and a viscoelastic model are introduced as examples of constitutive equations which are routinely used in engineering calculations. The constitutive equations are all suitable for problem involving large deformations and finite strains. The plasticity and creep models are in rate form and use the symmetric part of the velocity gradient or the stretching to compute the co-rotational time derivative of the Cauchy stress. The viscoelastic model computes the current value of the Cauchy stress from a hereditary integral of a materially invariant form of the stretching history. The current configuration is selected for evaluation of equilibrium as opposed to either the reference configuration or the last established equilibrium configuration. DOE

N83-15257# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A TIME INVARIANT STATE ESTIMATOR FOR CONTINUOUS TIME SYSTEMS
Dai Guanzhong (Northwestern Polytechnical Univ.) *In its* Acta Aeron. et Astron. Sinica (FTD-ID(RS)T-0518-82) 28 Jul. 1982 p 121-142 refs Transl. into ENGLISH from Acta Aeron. et Astron. Sinica (China), v. 2, no. 4, Dec. 1981 (For primary document see N83-15249 06-01)
Avail: NTIS HC A10/MF A01

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N83-16094# Stanford Univ., Calif. Dept. of Statistics.
A MIXING DISTRIBUTION APPROACH TO ESTIMATING PARTICLE SIZE DISTRIBUTIONS
Anthony Yung C. Kuk 19 Oct. 1982 132 p refs
(Contract N00014-76-C-0475)
(AD-A120687; SU-TR-328) Avail: NTIS HC A07/MF A01 CSCL

12/1

Spherical particles are dispersed randomly in a three dimensional body. The centers of the spheres are distributed according to a dilute Poisson process. The radii of such spheres have a distribution G independent of everything else. A random probe (line, plane or thin slice) is cut through the volumes. Taking the viewpoint of nonparametric estimation of mixing distributions, we propose a new procedure that deals with the shortcomings of the classical procedures. We consider linear, planar and thin slice data. In all three cases, our approach performs better than the classical procedure. In addition, we prove consistency results. In the random plane case, we discuss the right way and the wrong way to bootstrap the distribution of a stereological estimate, corresponding to whether we have taken the structure of the problem into account or not. In the thin slice case, when G is mixed or discrete, the formulas involve a decomposition of H into its continuous and discrete component. This makes the estimation problem more complicated but also more interesting especially in the discrete case. We propose a few procedures which involve a decomposition of the data corresponding to that of H. GRA

N83-16095*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GENERATION OF PSEUDO-RANDOM NUMBERS
Leonard W. Howell and Mario H. Rheinfurth Dec. 1982 26 p refs
(NASA-TP-2105; NAS 1.60:2105) Avail: NTIS HC A03/MF A01 CSCL 12A

Practical methods for generating acceptable random numbers from a variety of probability distributions which are frequently encountered in engineering applications are described. The speed, accuracy, and guarantee of statistical randomness of the various methods are discussed. M.G.

N83-16096# Oklahoma State Univ., Stillwater. Dept. of Statistics.
ON FORECASTING WITH UNIVARIATE AUTOREGRESSIVE PROCESSES: A BAYESIAN APPROACH
Lyle Broemeling and Margaret Land (Texas A and I Univ., Kingsville) 26 Jul. 1982 24 p refs
(Contract N00014-82-K-0292)
(AD-A120838; OSU-TR-37) Avail: NTIS HC A02/MF A01 CSCL 12/1

Using a normal-gamma prior density for the parameters of a p-th order autoregressive process, the Bayesian predictive density of k future observations is derived. It is shown that the joint predictive density of k future observations may be expressed as the product of k univariate t densities. Our results are illustrated with one-step ahead forecasts employing an AR(1) model with a conjugate prior density for the parameters. Author (GRA)

N83-16097# California Univ., San Diego, La Jolla. Dept. of Mathematics.
A FOURTH ORDER DECONVOLUTION TECHNIQUE FOR NON-GAUSSIAN LINEAR PROCESSES
Ken-Shin Lii and M. Rosenblatt Sep. 1982 23 p refs
(Contract N00014-81-K-0003)
(AD-A120663) Avail: NTIS HC A02/MF A01 CSCL 12/1

In Lii and Rosenblatt (1982) a deconvolution scheme for nonGaussian linear processes making use of third order moments (or spectra) was presented. This is appropriate for such processes with nonzero third order central moments. However, if the third order moments are zero (this could happen in the case of symmetric distributions) it is appropriate to look for a fourth order technique that would be effective. Such a scheme is presented and discussed in this paper together with some illustrative examples. GRA

N83-16098# North Carolina Univ., Chapel Hill. Inst. of Statistics.
TRANSIENT CUMULATIVE PROCESSES
Emily Stough Murphree Nov. 1981 177 p refs
(Contract N00014-76-C-0550)
(AD-A120735; Mimeo-Ser-1367) Avail: NTIS HC A08/MF A01 CSCL 12/1

Preliminary results on transient processes, the sub-expontential and expontential cases, the cumulants of transient renewal processes, the conditional cumulants of cumulative processes, and processes with variable defects are discussed. M.G.

N83-16099# Naval Ocean Systems Center, San Diego, Calif.
CONSISTENT AUTOREGRESSIVE SPECTRAL ESTIMATION FOR NOISE-CORRUPTED AUTOREGRESSIVE TIME SERIES Final Report, Oct. 1981 - Mar. 1982
D. G. Gingras 30 Mar. 1982 22 p refs
(ZR0140813)
(AD-A120722; NOSC-TR-780) Avail: NTIS HC A02/MF A01 CSCL 12/1

For the case when the observed series consists of the sum of an autoregressive process of known order and white noise the application of autoregressive spectral estimation methods may not be correct. The presence of the additive noise introduces zeros which are not adequately modeled by an autoregressive model. In this report an autoregressive spectral estimator for the noise-corrupted case is developed and shown to be consistent. The high-order Yule-Walker equations are used to estimate the autoregressive parameters from the noise-corrupted observations. A least squares estimate for the variance of the innovations sequence is also developed and shown to be consistent. These consistent estimates for the autoregressive parameters and the innovations variance are used to form the consistent autoregressive spectral estimates. Author (GRA)

N83-16100# Texas A&M Univ., College Station. Inst. of Statistics.
STATISTICAL MODELING OF BIVARIATE DATA Ph.D. Thesis
Terry Joe Woodfield Aug. 1982 271 p refs
(Contract DAAG29-80-C-0070)
(AD-A119915; TR-B-7; ARO-16992.13-MA) Avail: NTIS HC A12/MF A01 CSCL 12/1

A technique for modeling bivariate data that is based on the theory of orthogonal expansions in a separate Hilbert space is examined. A new nonparametric density estimation procedure is developed using an information criterion and is shown to be equivalent to least squares estimation of a density when the criterion function is computed with respect to the empirical distribution function. Computer programs are presented that implement the procedure for the univeriate and bivariate cases. Examples utilizing these programs are given and comparisons made to existing density estimation techniques. Author (GRA)

N83-16101# San Diego State Univ., Calif. Dept. of Mathematical Sciences.
SIGNAL DETECTION: GAUSSIAN AND NON-GAUSSIAN MODELS WITH NUISANCE PARAMETERS
C. B. Bell Jul. 1982 35 p refs
(Contract N00014-80-C-0208)
(AD-A120827; Rept-3-82) Avail: NTIS HC A03/MF A01 CSCL 12/1

Signal detection problems are treated in the context of several Gaussian and non-Gaussian stochastic processes with one or more nuisance parameters. The techniques all entail a basic data transformation and the use of a Kolmogorov-type statistic on one or more components of the transformed data. Extraneous statistical noise and randomized rank statistics are employed. Numerical examples are given. Author (GRA)

N83-16102# Stanford Univ., Calif. Dept. of Statistics.
THE PROBLEM OF SELECTING A GIVEN NUMBER OF REPRESENTATIVE POINTS IN A NORMAL POPULATION AND A GENERALIZED MILLS RATIO
Kai-Tai Fang (Academia Sinica) and Shu-dong He (Huazheng Inst. of Technology) 4 Oct. 1982 30 p refs
(Contracts N00014-76-C-0475; DAAG29-82-K-0156; NR Proj. 042-267)
(AD-A120686; SU-TR-327; SU-TR-5) Avail: NTIS

HC A03/MF A01 CSCL 12/1

In a known normal population, one desires to select a given number of representative points that retain as much information about the population as possible. To obtain these points, the solution of two systems of equations is required. Some properties of these equations are discussed. As natural consequence a generalized Mills' ratio is defined. Some basic properties of the generalized Mills' ratio for studying the above equation are listed. A computational procedure is given to obtain these points and tables of them and corresponding probabilities are given for m < or = 31, where m is the number of points. Author (GRA)

N83-16103# Stanford Univ., Calif. Dept. of Statistics.
LARGE SAMPLE THEORY FOR SEQUENTIAL ANALYSIS OF THE PROPORTIONAL HAZARDS MODEL
Thomas Selike Aug. 1982 89 p refs
(Contract N00014-77-C-0306; NR Proj. 042-373)
(AD-A120646; SU-TR-20) Avail: NTIS HC A05/MF A01 CSCL 12/1

An appropriate large sample theory for sequential analysis of the Cox proportional hazards model is developed. For clinical trials with simultaneous entry of patients, the efficient score process of the partial likelihood is easily seen to be a martingale. It follows that, in a time scale based on the observed Fisher information, the score process and the properly normalized maximum partial likelihood estimator behave asymptotically like Brownian motion. When entry is staggered, the efficient score process is no longer a martingale in general. However, if patients in a staggered-entry clinical trial are assumed to be independent and identically distributed, independently of entry time, then the score process is well approximated by a martingale. The asymptotic results involving weak convergence to Brownian motion hold as before.
Author (GRA)

N83-16104# California Univ., San Diego, La Jolla. Dept. of Mathematics.
MODEL IDENTIFICATION AND ESTIMATION OF NONGAUSSIAN ARMA PROCESSES
Keh-Shin Lii 1982 28 p refs
(Contract N00014-81-K-0003)
(AD-A120662) Avail: NTIS HC A03/MF A01 CSCL 12/1

Finite parameter models of ARMA type have been used extensively in many applications. Under the usual Gaussian assumption, the second order analysis will not be able to discriminate among competing models which give the same correlation structure. In many applications the innovation process is non-Gaussian. In this case, analysis using hgher order moments will identify the model uniquely without the usual invertibility assumption. This in turn will affect the forecasting based on the non-Gaussian model. We present a method which uses bispectral analysis and the Pade approximation. We show that the method will consistently identify the order of the ARMA model and estimate the parameters of the model. One could also deconvolve the process to estimate the innovative process which will provide information for possible more efficient maximum likelihood estimation of the parameters. Asymptotic distributions are given, and a few examples are presented to illustrate the effectiveness of the method. Author (GRA)

N83-16105# Princeton Univ., N. J. Information Sciences and Systems Lab.
NON-GAUSSIAN AND MULTIVARIATE NOISE MODELS FOR SIGNAL DETECTION
A. B. Martinez and John B. Thomas Sep. 1982 170 p refs
(Contract N00014-81-K-0146)
(AD-A120772; TR-6) Avail: NTIS HC A08/MF A01 CSCL 09/4

This report deals with the problems of detecting a known signal in non-Gaussian or dependent noise. Although likelihood ration (LR) detectors are discussed, primary attention is paid to asymptotic detector performance, and therefore to maximum efficacy or locally optimal (LO) detectors. The detectors considered consist of a nonlinearity followed by a filter and a threshold comparator. The asymptotic performance of three common suboptimal detectors is considered for several families of noise densities as the input signal-to-noise ratio (SNR) varies. Contours of equal detector performance are plotted allowing the relative utility of the detectors to be assessed. A method of designing suboptimal detector nonlinearities is presented. A suboptimal nonlinearity is chosen, and the family of densities for which it is locally optimal is found. A member of this family is then fitted to the observed noise, and the corresponding detector is used. When the nonlinearity is a rational function, the Pearson family of densities results. GRA

N83-16106# California Univ., Berkeley. Statistical Lab.
FUNDAMENTAL RESEARCH IN MATHEMATICAL STATISTICS AND PROBABILITY; STOCHASTIC PROCESSES Final Report, 1 Apr. 1976 - 30 Jun. 1982
Lucien LeCam and Elizabeth L. Scott 24 Sep. 1982 16 p refs
(Contract DAAG29-79-C-0093; Grant DAAG29-76-G-0167)
(AD-A119878; ARO-13676.12-MA; ARO-16427.15-MA) Avail: NTIS HC A02/MF A01 CSCL 12/1

Brief description of research findings for the period 1 April 1976 to 30 June 1982: The results refer to a number of topics in the construction of tests or estimates with applications to selection procedures for studies, weather modification, tests of fit for logistic models competing risks, identifiability in Markov processes. A list of papers published and a list of Ph.D. granted are appended. GRA

N83-16107# Aerospace Corp., El Segundo, Calif. Guidance and Control Div.
SEQUENTIAL PARAMETER ESTIMATION IN EXPONENTIAL AUTOREGRESSIVE PROCESSES Final Technical Report
M. R. Chernick and V. K. Murthy 15 Sep. 1982 16 p refs
(Contract F04701-81-C-0082)
(AD-A120569; TR-0082(9990)-2; SD-TR-82-66) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper generalizes the sequential estimation of autoregressive parameters as given in Gaver and Lewis (1980) of pth order processes EAR(p) and GAR(p). The first two moments of the stopping time distribution are computed for the EAR(2) process, a procedure for estimating the parameter lambda is given, and a simulation is given to show how large the stopping time can be for various alpha 1 and alpha 2. GRA

N83-16108# Decision Research Corp., Eugene, Oreg.
HYPOTHESIS TESTING FROM A BAYESIAN PERSPECTIVE
Baruch Fischhoff (UK Medical Research Council, Cambridge) and Ruth Beyth-Marom Jul. 1982 60 p refs Sponsored in part by UK Medical Research Council
(Contract N00014-80-C-0150; NR Proj. 197-064)
(AD-A120574; PTR-1092-82-6) Avail: NTIS HC A04/MF A01 CSCL 12/1

The descriptive potential of Bayesian inference is exploited. A set of logically possible forms of non-Bayesian behavior is identified. Second, it reviews existing research in a variety of areas in order to see whether these possibilities are ever realized. The analysis shows that in some situations, several apparently distinct phenomena are usefully viewed and previous investigations have conferred a common label (e.g., confirmation bias) to several distinct phenomena. It also calls into question a number of attributions of judgmental bias, suggesting that in some cases the bias is different than what has previously been claimed, whereas in others, there may be no bias at all. Author

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N83-16109# Stanford Univ., Calif. Dept. of Operations Research.
A PRODUCTION NETWORK MODEL AND ITS DIFFUSION APPROXIMATION

Michael Louis Wenocur Sep. 1982 106 p refs
(Contract N00014-75-C-0561; Grant NSF ECS-80-17867; NR Proj. 047-200)
(AD-A120685; SU-TR-207; SU-TR-68) Avail: NTIS HC A06/MF A01 CSCL 13/8

This report develops and analyzes a general stochastic model of a production system. The model is closely related to Harrison's (5) assembly-like queueing network, the principal difference being that here we assume all storage buffers have finite capacity. Our attention is focused on a vector stochastic process Z whose components are the contents of the various storage buffers (as functions of time). The principal result is a weak convergence theorem of the type developed by Iglehart and Whitt (7) for queues in heavy traffic. This limit theorem shows that, with large buffers and balanced loading of the system's work stations, a properly normalized version of the storage process Z can be well approximated by a certain vector diffusion process Z*. We construct Z* by applying a particular (and rather complicated) reflection mapping to multidimensional Brownian motion. Various properties of the limiting diffusion Z* are developed, but these provide only a modes beginning for the analytical theory that must be developed before our limit theorem can lead to practically useful approximation procedures. GRA

N83-16110# Stanford Univ., Calif. Dept. of Statistics
A TANDEM STORAGE SYSTEM AND ITS DIFFUSION LIMIT
J. Michael Harrison and L. A. Shepp (Bell Labs.) Jun. 1982 36 p refs
(Contract N00014-75-C-0561; Grant NSF ECS-80-17867)
(AD-A120644; SU-TR-204; SU-TR-66) Avail: NTIS HC A03/MF A01 CSCL 12/1

We consider a two-dimensional diffusion process Z(t) = (Z sub 1(t), Z sub 2 (t)) that lives in the half strip (0 < or = Z sub 1 < or = 1, 0 < or = Z sub 2 < infinity. On the interior of this state space, Z behaves like a standard Brownian motion (independent components with zero drift and unit variance), and there is instantaneous reflection at the boundary. The reflection is in a direction normal to the boundary at Z sub 1 = 1 and Z sub 2 = 0, but at Z sub 2 = 0, but as Z sub 1 = 0 the reflection is at an angle theta below the normal (0 < theta < pi/2). This process Z is shown to arise as the diffusion limit of a certain tandem storage or queueing system. It is shown that Z(t) has a non-defective limit distribution F as t yields infinity, and the marginal distributions of F are computed explicitly. The marginal limit distribution for Z sub 1 is uniform (this result is essentially trivial), but that for Z sub 2 is much more complicated. GRA

N83-16111# Army Inventory Research Office, Philadelphia, Pa.
THE OUTPUT OF M(T)/G(T)/INFINITY QUEUES
Meyer Kotkin Jul. 1982 22 p refs
(AD-A120545; USAIRO-TR-82/2) Avail: NTIS HC A02/MF A01 CSCL 12/1

We study an infinite server queue in which the arrival process is a Non-Homogeneous Poisson Process (NHPP) and in which the service times of customers may depend on the time service was initiated. We establish a splitting theorem for NHPP similar to the well known splitting theorem for Stationary Poisson Process. With this theorem, we show that the departure process of the M(t)/G(t)/infinity queue is a NHPP, and that the number of departures during any interval is independent of the number of remaining customers at the end of the interval. The splitting theorem can also be used to show that the number of busy servers at any time is Poisson distributed. Author (GRA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N83-16112*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NUMERICAL COMPUTATION OF EXPONENTIAL MATRICES USING THE CAYLEY-HAMILTON THEOREM
Harvey Walden and E. C. Roelof (APL, Laurel, Md.) Jul. 1982 28 p refs
(NASA-TM-83982; NAS 1.15:83982) Avail: NTIS HC A03/MF A01

A method for computing exponential matrices, which often arise naturally in the solution of systems of linear differential equations, is developed. An exponential matrix is generated as a linear combination of a finite number (equal to the matrix order) of matrices, the coefficients of which are scalar infinite sums. The method can be generalized to apply to any formal power series of matrices. Attention is focused upon the exponential function, and the matrix exponent is assumed tri-diagonal in form. In such cases, the terms in the coefficient infinite sums can be extracted, as recursion relations, from the characteristic polynomial of the matrix exponent. Two numerical examples are presented in some detail: (1) the three dimensional infinitesimal rotation rate matrix, which is skew symmetric, and (2) an N-dimensional tri-diagonal and symmetric finite difference matrix which arises in the numerical solution of the heat conduction partial differential equation. In the second example, the known eigenvalues and eigenvectors of the finite difference matrix permit an analytical solution for the exponential matrix, through the theory of diagonalization and similarity transformations, which is used for independent verification. The convergence properties of the scalar infinite summations are investigated for finite difference matrices of various orders up to ten, and it is found that the number of terms required for convergence increases slowly with the order of the matrix. Author

N83-16113# Aerotherm Acurex Corp., Mountain View, Calif. Aerospace Systems Div.
A NONLINEAR FUNCTIONAL DIFFERENTIAL EQUATION IN BANACH SPACE WITH APPLICATIONS TO MATERIALS WITH FADING MEMORY
William J. Hrusa Aug. 1982 76 p refs
(Grant AF-AFOSR-0198-81; AF Proj. 2304)
(AD-A120447; LCDS-82-19; AFOSR-82-0904TR) Avail: NTIS HC A05/MF A01 CSCL 12/1

The report studies a nonlinear functional differential equation in Banach space. This equation is an abstract form of the equations of motion for nonlinear materials with fading memory. Its basic structure is hyperbolic in character so that global smooth solutions should not be expected in general. Memory effects, however, may induce a dissipative mechanism which, although very subtle, is effective so long as the solution is small. The report shows that if the memory is dissipative in an appropriate sense, then the history value problem associated with our equation has a unique global smooth solution provided the initial history and forcing are suitably smooth and small. The proof combines a fixed point argument to establish local existence with a chain of global a priori energy-type estimates. The abstract results are then applied to establish global existence of smooth solutions to certain history value problems associated with the motion of nonlinear materials with fading memory, under assumptions which are realistic within the framework of continuum mechanics. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N83-16114# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
ELEVENTH CZECHOSLOVAK SEMINAR ON PLASMA PHYSICS AND TECHNOLOGY
Oct. 1981 167 p refs Seminar held in Zvikov, Czechoslovakia, 7-9 Oct. 1981
(IPPCZ-244) Avail: NTIS HC A08/MF A01

Various aspects of plasma physics and Tokamak devices are discussed. Emphasis is placed upon plasma heating. Radio frequency heating, magnetohydrodynamic waves, toroidal plasmas,

plasma-electromagnetic interaction, and plasma density are among the topics discussed. For individual titles, see N83-16115 through N83-16140. R.J.F.

N83-16115# Kurchatov (I. V.) Inst. of Atomic Energy, Moscow (USSR).
TOKAMAK RESEARCH IN THE SOVIET UNION c75
V. S. Strelkov *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 3-13 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

Experimental research and engineering to provide the basis for fusion reactor design are discussed. Various methods of plasma heating are discussed. Magnetohydrodynamic waves, toroidal fields, radio frequency heating, microwave frequencies, cyclotron radiation, and adiabatic compression are discussed. R.J.F.

N83-16116# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
LOWER-HYBRID HEATING EXPERIMENT ON THE TM-1-MH TOKAMAK c75
J. Datlov, K. Jakubka, Vl. Kopecky, S. Koerbel, L. Kryska, P. Magula, J. Stoeckel, and F. Zacek *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 37-40 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

During preliminary experiments on the plasma heating region in the TM-1-MH device high frequency (HF) power up to 100 kW at the frequency of 616 MHz was injected into the Tokamak by means of a loop fed by a coaxial line. The process of HF field-plasma interaction was found strongly nonlinear in the whole 3 to 100 kW power range. It takes place predominantly at the periphery of the plasma column. Electron density increase during the heating process was reduced by working at various temperatures of the liner up to 300 C. R.J.F.

N83-16117# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
POWER SPECTRUM OPTIMIZATION OF THE THREE-WAVEGUIDE GRILL FOR THE T-7 TOKAMAK c75
J. Preinhaelter, Z. Sedlacek, and S. Koerbel *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 41-46 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

Phased array of waveguides, named the grill, is usually used as a coupling structure in experiments with the lower hybrid resonance heating of plasma. In this case the grill consists of three elements. In the theoretical model it is assumed that the height of waveguides is infinite (in the y-direction) and the slab geometry is adopted with the x-axis along the toroidal magnetic field. The field in waveguides is assumed to be the sum of transverse magnetic modes (in numerical computations 10 modes were taken), from which only the first mode is propagating and the others are evancescent. It is also supposed that only the slow wave is present in the plasma and that the plasma density profile is linear. R.J.F.

N83-16118# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
SHORT WAVELENGTH LOWER HYBRID WAVES NONLINEARLY EXCITED DUE TO PONDEROMOTIVE DENSITY MODULATION c75
R. Klima, I. M. Pankratov, P. Pavlo, and V. A. Petrzilka *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 47-51 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

One of several nonlinear mechanisms that can play a role in the lower hybrid heating process is discussed. Nonlinear density modulation due to ponderomotive forces is investigated. In the model, the magnetostatic field B sub 0 is parallel to the x-axis, while the x-axis is parallel to the density (and temperature) gradient. Because of the strong decrease of density modulation with increasing temperature, the nonlinearity is assumed to be negligible inside the plasma at a certain x = x sub f. High frequency field is launched from a waveguide array, separated from the plasma by a thin vacuum region. R.J.F.

N83-16119# State Coll. of Mining and Metallurgy, Ostaua-Poruba (Czechoslovakia). Dept. of Physics.
ELECTRON IMPACT IONIZATION OF HIGHLY CHARGED MOLYBDENUM IMPURITIES IN TOKAMAK PLASMAS c75
V. Strzondala *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 52-53 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

Estimations of cross sections of molybdenum ions are discussed. An approximate calculation of the electron impact cross sections of ions is expressed. R.J.F.

N83-16120# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
ANDROMEDA: THE SYSTEM FOR THE ACQUISITION AND NUMERICAL DATA PROCESSING AND ITS APPLICATION FOR EXPERIMENTAL DEVICE TOKAMAK TM-1-MH c75
L. Kryska and S. Koerbel *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 54-55 (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

The operation of the Tokamak TM-1-MH experimental device demands a system for the registration and numerical processing of analog transient signals from various diagnostic sensors. These signals of relatively short duration (up to 10 ms) have a repetition period of 4 to 5 min approximately. A system, ANDROMEDA, for the registration and digital processing of analog transient signals from various diagnostic sensors in a Tokamak device is discussed. The four basic working regimes of the system ANDROMEDA are as follows: the registration of signals in the electronic buffer memory; the reconstruction of registered informations (the repetition regime); the transfer of collected data into the computer and the numerical processing of these data; and the displaying, plotting and printing of processed data (oscilloscope, plotter, printer). The data acquisition subsystem can be operated independently as an autonomous 16-channel digital-memory oscilloscope. R.J.F.

N83-16121# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
SOFT X-RAY DIAGNOSTICS ON TOKAMAK TM-1-MH c75
P. Magula *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 56-59 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

Two kinds of soft X-ray detectors (the gas proportional detector and liquid nitrogen cooled Si (Li) detector) are used at the TM-1-MH Tokamak for the measurement of electron temperature T sub e and for the determination of the influence of high frequency (HF) heating on the electron distribution function in the Tokamak plasma. The heating experiments were made in two ranges of frequencies: 1,25 GHz and 616 MHz. In the first experiment at 1,25 GHz a magnetron was used as a power generator and T sub e(O) was determined by means of the gas proportional counter with the Be window of 0.0001 m thickness. The soft X-ray spectrum was measured in the 1,5 keV to 5 keV energy range. From the comparison of the X-ray spectra with and without HF heating respectively, it can be seen the influence of the HF heating starting from 2,7 keV energy which appears in the form of a tail in the distribution function with the temperature T sub e = 710 eV. Supposing that the level and composition of impurities do not change during the application of HF impulse it can be appreciated that approximately 1% of electrons are heated, consuming totally 0,5 kW of HF power. The Tcherenkov damping of electrons is supposed to be the absorption mechanism for the HF wave.R.J.F.

N83-16122# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
ENERGY BALANCE IN TM-1-MH TOKAMAK (OHMICAL HEATING) c75

J. Stoeckel, S. Koerbel, L. Kryska, V. Kopecky, V. Dadalec, J. Datlov, K. Jakubka, P. Magula, F. Zacek, G. V. Pereverzev (Kurchatov Inst. of Atomic Energy) et al *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 60-64 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

Plasma in the TM-1-MH Tokamak was experimentally studied in the parameter range: tor. mg. field B = 1,3 T, plasma current I sub p = 14 kA, electron density N sub E < 3.10 to the 19th power cubic meters. The two numerical codes are available for the comparison with experimental data. TOKATA-code solves simplified energy balance equations for electron and ion components. TOKSAS-code solves the detailed energy balance of the ion component. R.J.F.

N83-16123# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
COMPUTER SIMULATIONS OF REFLEX E-BEAM SYSTEMS AND PLASMA STABILITY **c75**
K. Jungwirth and P. Stavinoha *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 77-93 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

A 1 1/2 dimensional PIC simulation model OREBIA was devised for systems with a virtual or reflex cathode to investigate various reflexing electron beam phenomena, dynamics of ions accelerated within the anode-cathode gap, ion beam generation, ion acceleration, evolution of the h,v, diode impedance and its matching to the external circuit, and further related phenomena. Schematics of the coupled to an external electric circuit model OREBIA-REX as well as of its central module OREBIA are illustrated. This model based on analytical estimates and set up in close correlation to experimental work was described in detail in the report. Following to its up to date version, electrons emitted from the (moving) surface of the cathode plasma and accelerated within the anode-cathode gap are scattered elastically and lose simultaneously some part of their energy at the (moving) boundaries of the anode (either externally or gas produced) plasma according to a foil-scattering model. B.W.

N83-16124# Institute of Nuclear Research, Swierk (Poland).
FUSION AT COUNTERSTREAMING ION BEAMS: IONS OPTIC FUSION (IOF) **c73**
M. Gryzinski *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 94-100 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

Different concepts of a controlled fusion energy release were developed during over one quarter century lasting investigations. Those were mostly based on the concept of magnetic confinement of thermalized plasma. In the last decade research on fusion energy production in inertially confined thermal plasma were strongly developed. A brief review of research on the fusion energy production at highly ordered motion of ions in counterstreaming ion beams is given. Author

N83-16125# Technical Univ. of Zamek (Czechoslovakia). Electrotechnical Faculty.
DEVELOPMENT OF CURRENT SHEAT ON OUTPUT OF COAXIAL GUN **c75**
J. Kravarik, P. Kubes, and J. Hruska *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 101-102 (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

The investigation of current sheat collapse has been directed to the maximum gain of plasma density, plasma temperature and neutron production. The evolution of collapse is dealt with in this paper. Author

N83-16126# Purkyne (J. E.) Univ., Kotlarska (Czechoslovakia). Dept. of Physical Electronics.
COATING OF LASER FUSION TARGETS BY PLASMA POLYMERIZED ORGANIC THIN FILMS **c36**
J. Janoa *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 103-104 (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

The laser fusion targets are the deuterium - tritium filled spherical glass shells of the order of 100 - 200 micrometers in diameter and coated with 5 to 30 micrometers of density - matching, low atomic number material. The coating material must be of uniform density having the surface imperfections less than 5 x 0.01 micrometers. The filled glass shells cannot be heated above 200 C since the permeation rate of the DT of the shell may increase rapidly. Among evaluated methods available for depositing thin layers of this type, the plasma polymerization was found to be the best approach. In the literature described experiments have shown that the plasma polymerized fluorocarbons produce coatings having the densities from 1.8 to 2.4 g/cu cm. Author

N83-16127# Academy of Sciences, Berlin (East Germany). Zentralinst. fuer Elektronenphysik.
NUMERICAL SIMULATION OF COLLECTIVE ION ACCELERATION **c72**
W. Hintze *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 105-106 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

A one dimensional particle simulation code was developed in order to study collective ion acceleration during injection of an IREB into initially neutral gas. Two different cases were treated: homogenous gas filling of the drift space, and gas cloud near the injection plane. Injection into a sharply localized ion source at the anode has been studied earlier. Contrary to our code, the diode region was included in the calculation. Details of our code are described. Electrons are injected with constant energy but with finite current risetime into a grounded drift space of length L which is filled with a gas from x = o to x = D(approx. < L). The gas is ionized by electron impact with a constant ionization frequency. The code was run for various combinations of the parameters. The main objective of the study was to assess the capability of a strictly one dimensional model. B.W.

N83-16128# Technical Univ. of Prague (Czechoslovakia).
ION VELOCITY MEASUREMENTS FOR LASER MASS ABLATION STUDIES **c36**
L. Pina *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 107-108 (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

The measurements used 10 J, 1.7 ns (FWHM), 1.06 micrometers laser pulse to irradiate flat Al targets. A range of lenses with focal lengths from 75 mm to 2000 mm were used to focus 50 mm diameter beam on target, resulting in a range of optical spot diameters from 30 micrometers to 3.5 mm. Irradiance on target was varied by inserting calibrated glass Nd filters in the main beam. Ion velocities were recorded using six time-of-flight Faraday cup collectors arrayed in the horizontal plane from 10 deg to 80 deg to the target normal at distances approx. 40 cm from the plasma. The focal spot size was measured by imaging the focal plane distribution onto infrared film. Ion velocities were calculated from the arrival time of the peak ion current. Polar ion velocity plots were extrapolated to determine the ion velocity normal to the target surface. These normal velocities were then plotted against irradiance I for each spot size. Random shots onto plastic targets showed no significant difference in measured velocities. B.W.

N83-16129# Academy of Sciences, Berlin (East Germany). Zentralinst. fuer Elektronenphysik.
CRATER FORMATION BY HIGH CURRENT DISCHARGES IN VACUUM **c75**
P. Siemroth and B. Juettner *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 109-111 refs (For primary document see N83-16114

06-70)
Avail: NTIS HC A08/MF A01

Metal vapor arcs between cold electrodes in an ambient vacuum (so-called vacuum arcs) are characterized by small hot spots that rapidly and stochastically move over the surface. These cathode spots are characterized by a very high current density, high temperature and plasma density. Typical erosion marks - the craters - are left behind by the spots. Craters are assumed to play an important role for the current transfer from the cathode to the discharge plasma. Futhermore, they reflect the effort of producing the plasma itself. Therefore, the crater formation describes the essential process of the discharge. Low current experiments were carried out. B.W.

N83-16130# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
SOFT X-RAY AND VUV EMISSION FROM REB-HEATED PLASMA IN REBEX 1 AMD REBEX 1 MACHINES c75
V. Piffl and V. Raus *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 112-113 (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

The measurements of soft X-ray spectra in REB-heated plasma experiments by means of a conventional scintillation technique is difficult due to the intense bremsstrahlung originating from interaction of beam electrons with a plasma and chamber walls. In the experiments with the REBEX 1 machine, predominantly radiation from a decaying plasma long after the beam injections pulse ($t > 0,5$ micro sec.) could be measured in this way, although very thin plastic scintillators were used. The absorption characteristics of X-ray emission from a plasma are measured and compared with calculated Maxwellian plasma emission for several temperatures. To detect ultrasoft X-ray and VUV emission two types of photoemission detectors were developed. Author

N83-16131# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
DYNAMICAL MODEL OF AN OVERHEATED MAGNETIZED PLASMA c75
K. Jungwirth and J. Ullschmied *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 114-115 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

In experiments on plasma heating by REB on the REBEX machine diamagnetic measurements represent a basic method for evaluation of the plasma energy content and of the efficiency of REB-to-plasma energy transfer. Variety of forms of the observed diamagnetic signals implies a complicated nature of the energy transfer processes. To interpret correctly the diamagnetic data a simple but fairly general model describing the heated plasma dynamics was developed. Author

N83-16132# Academy of Sciences, Berlin (East Germany). Zentralinst. fuer Elektronenphysik.
DYNAMICS OF IONIZATION AND TRANSPORT IN A MAGNETICALLY CONFINED PLASMA COLUMN c75
H. Prinzler and P. Heymann *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 118-125 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

Transport processes in magnetized low temperature plasmas have been investigated during the past two decades up to the present. They are stimulated by the dominant role of anomalous transport in fusion devices, where the concept of wave induced perpendicular losses gives a promising model for physical explanation. A disturbance of the plasma equilibrium distributed nearly homogeneous along the plasma column is used. The propagating density perturbation in radial direction is observed. It was found that the perturbation propagates in an anomalous way with enhanced perpendicular transport, caused by a discrete spectrum of correlated drift-like modes. From the field equations for electrons and ions a rectangular slab model introduced by Aldrige and Keen has been derived which gives the dispersion of dissipative drift wave modes (Ellis, et al., 1980). B.W.

N83-16133# Institute of Physics and Technology of Radiation Devices, Bucharest (Rumania).
A TIME RESOLVING METHOD FOR DETERMINING THE ENERGY SPECTRUM OF NEUTRONS EMITTED BY A PLASMA FOCUS DEVICE c75
I. I. Popescu and M. Vlad *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 126-127 ref (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

A method to obtain the time evolution of the energy spectrum f(v,t)) of the neutrons emitted by a deuterium plasma produced in a plasma focus device is proposed. The neutrons do not interact with the magnetic and electric fields and have negligible interaction with discharge vessel walls, the knowledge of their energy spectrum provides very accurate information on the neutron production mechanism present in the plasma focus. Neutron measurements determine the time averaged energy spectrum only. Such measurements are made by the time of flight method, and by recording the proton recoils in nuclear emulsions. The two methods, used on the same discharge give different results which indicates the existence of a time dependence in the neutron energy spectrum. E.A.K.

N83-16134# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
APPARATUS FOR PLASMA ELECTRON TEMPERATURE AND DENSITY MEASUREMENTS BY THOMSON SCATTERING c75
K. Kolacek and V. Babicky *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 128-129 refs (For primary document see N83-16114 06-71)
Avail: NTIS HC A08/MF A01

The Thomson scattering technique is based on fact, the monochromatic radiation passing a plasma is under certain circumstances dominantly scattered by freely moving electrons which causes its frequency to broaden by Doppler effect. A wavelength analysis of the scattered light yields an information on the electron motion and hence on the electron temperature, while the total power of the scattered light is proportional to the number of scattering centers and hence to the electron density. Since the Thomson scattering cross section is small, an application of this technique was not possible only by giant pulse lasers with well collimated beams. Thomson scattering apparatus consists of the following parts: the laser, the interaction chamber and the detection system. The detection part enables the measurement of the scattered light spectrum in six spectral channels during one laser shot. By changing the dispersing element of the polychromator it is possible to change the dispersion range. E.A.K.

N83-16135# College of Mechanical and Electrical Engineering, Plzen (Czechoslovakia). Dept. of Physics.
DIAGNOSTICS OF NONEQUILIBRIUM HYDROGEN PLASMA c75
J. Ferdinand *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 130-134 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

Electron temperature measurements in low electron density plasma are discussed. Special plasma models are required in diagnostics of nonequilibrium plasma. Coronal and collisional radiative models are used. In low electron density regions the results obtained by both models are nearly equal. Both models allow to use for electron temperature measurements the method of ratio of intensities of two spectral lines. Hydrogen glow discharge is verified. E.A.K.

N83-16136# Research Inst. of Electrical Apparatus, Brno (Czechoslovakia).
EQUIDENSITOMETRICAL EVALUATION OF A FILM RECORD OF AN SF6 SWITCHING ARC c33
B. Svejda and B. Gross (Technical Univ., Brno, Czechoslovakia)

In Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 135-138 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

An electric switching arc in a nozzle of an SF sub 6 circuit breaker was photographed by a high speed camera. The SF sub 6 circuit breaker used for the experiment was specially modified for physical measurements. These conditions allow an optical reach of the inside nozzle space and observation of the whole opening operation. The instantaneous position of the electrodes is recorded exactly and a special adaptation of the high speed camera allows it to obtain an unambiguous correlation between electrical parameters of the observed switching arc and the respective photorecord of the arc. E.A.K.

N83-16137# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
GLOBAL MODEL OF A HYBRID TOKAMAK REACTOR WITH AN AUXILIARY RF HEATING **c75**
L. Krlin, P. Pavlo, and Z. Tluchor *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 143-152 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

Estimates of basic parameters of a model of the hybrid Tokamak reactor are presented. For an auxiliary plasma heating, the absorption of lower hybrid waves is considered. The typical reactor parameters, the outgoing power, the power obtained by the deposition of the energy of alpha particles, the RF power absorbed in the plasma, the driven current coupled with the RF absorption and the production rate of the plutonium are estimated. E.A.K.

N83-16138# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
SIMULATION CODE OF RELATIVISTIC ELECTRON BEAM DIODES **c33**
P. Vrba *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 153-156 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

The opposing relativistic electron and ion flows in own or applied electric and magnetic fields inside the cylindrical diode were numerically analyzed. A finite size particle quasistatic computer model is developed via self consistent solution by differential equations. The behavior of relativistic electron and ion flux in self consistent electric and magnetic fields near the maximum of voltage pulse is determined. E.A.K.

N83-16139# College of Mechanical and Electrical Engineering, Plzen (Czechoslovakia). Dept. of Physics.
HELIUM POPULATION MODEL **c75**
J. Slavik *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 157-159 (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

The radiation - scattering models of plasma were numerically analyzed. The construction of such a model for helium plasma which enables study of metastable state effects and their relatively many atomic data are discussed. E.A.K.

N83-16140# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
NUMERICAL SIMULATION OF THE INTERACTION OF AN ELECTROMAGNETIC WAVE WITH AN INHOMOGENEOUS PLASMA **c75**
J. Lacina and J. Preinhaelter *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 160-162 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

Heating by high frequency waves was studied. A numerical code which enables the study of incidence of an electromagnetic wave on an inhomogeneous plasma was developed. The one dimensional model which are nonmagnetized plasma of the two fluid equations with a finite electron pressure and with the adiabatic condition for all processes is described. It is stipulated that in the initial moment the plasma builds up a slab with a symmetrical profile for both the density and the electron temperature. The equilibrium is attained by the presence of the symmetrical gravitational field. The incident wave on the plasma boundary fulfills the nonreflecting boundary conditions. The problem is solved by finite difference method. The results of the computation agree with the quasilinear theory of the ponderomotive forces. E.A.K.

N83-16141# Army Night Vision Lab., Fort Belvoir, Va. Night Vision and Electro-Optics Lab.
ELECTRICAL PROPERTIES OF HEATED DIELECTRICS
Edward J. Sharp and Lynn E. Garn 18 Jun. 1982 15 p refs Presented at the Army Sci. Conf., 15-18 Jun. 1982
(AD-A117315) Avail: NTIS HC A02/MF A01 CSCL 20/3

A method has been described which allows one to analyze complicated currents emanating from warmed dielectrics. This technique is easily applied for temperature waves of certain amplitude and frequency limits and permits an accurate assessment of dielectric materials being examined for specific applications, such as infrared detectors or vidicon targets, where it is necessary to know the current magnitude and relaxation properties as a function of temperature and temperature changes. The low-frequency temperature wave method is a direct dynamic measurement of the pyroelectric coefficient. This method eliminates the nedd for measurements of specific heats, dielectric constants, and radiation absorption coefficients as well as identifying the effects due to irreversible currents which occur when samples are heated at a constant rate. GRA

N83-16142# Naval Research Lab., Washington, D. C.
LINEAR THEORY OF THE E X B INSTABILITY WITH AN INHOMOGENEOUS FIELD
J. D. Huba, S. L. Ossakow, P. Satayanarayana, and P. N. Guzdar 13 Oct. 1982 55 p refs
(AD-A120821; NRL-MR-4901) Avail: NTIS HC A04/MF A01 CSCL 20/3

A general linear theory of the E X B instability is developed which considers an ambient electric field that is at an arbitrary angle to the density gradient, and allows the electric field component parallel to the density gradient to be inhomogeneous. A differential equation is derived which describes the mode structure of the unstable waves in the direction of the inhomogeneities. The theory (1) includes ion inertia effects; (2) allows for arbitrary density and electric field profiles; and (3) is valid in the long wavelength regime, i.e., k sub y L $<$ 1 where L is the width of the boundary layer. The main results of the analysis are as follows. First, the inhomogeneous velocity flow caused by the inhomogeneous electric field can stabilize the instability. Second, short wavelength modes are preferentially stabilized over longer wavelength modes. Third, the stabilization mechanism is associated with the x dependent, Doppler-shifted frequency omega -k sub y V sub y (X), where V sub y (x) = - cEx(x)/B. And fourth, the marginal stability criterion is weakly dependent on the magnitude of nu(in)/omega. Applications of these results to ionospheric phenomena are discussed, viz., barium cloud striations and high latitude F region irregularities. GRA

N83-16143# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICS (SELECTED ARTICLES)
Zhu Shiyao, Chen Zesheng, Xu Xiaolung, and He Qiang 10 Sep. 1982 25 p refs Transl. into ENGLISH from Wuli (China), v. 10, no. 8, Aug. 1981 p 488-490
(AD-A119830; FTD-ID(RS)T-0802-82) Avail: NTIS HC A02/MF A01 CSCL 20/8

Controlled nuclear fusion as a new energy source was investigated. It will be possible in the 1980's to obtain thermal nuclear ignition, and in the early 2000's nuclear fusion may be used to supplement the energy shortage. It is predicted that in the 2000's nuclear fusion will occupy an important position as a global source of energy. E.A.K.

N83-16144# California Univ., San Diego, La Jolla. Dept. of Physics.
AB INITIO INFRARED AND RAMAN SPECTRA
Donald R. Fredkin, Andrew Komornicki (Polyatomics Research Inst., Mountain View, Calif.), Steven R. White, and Kent R. Wilson Aug. 1982 41 p refs Submitted for publication
(Contract N00014-78-C-0325)
(AD-A120768; TR-9) Avail: NTIS HC A03/MF A01 CSCL 07/4

We discuss several ways in which molecular absorption and scattering spectra can be computed ab initio, from the fundamental constants of nature. These methods can be divided into two general categories. In the first, or sequential, type of approach, one first solves the electronic part of the Schroedinger equation in the Born-Oppenheimer approximation, mapping out the potential energy, dipole moment vector (for infrared absorption) and polarizability tensor (for Raman scattering) as functions of nuclear coordinates. Having completed the electronic part of the calculation, one then solves the nuclear part of the problem either classically or quantum mechanically. As an example of the sequential ab initio approach, the infrared and Raman rotational and vibrational-rotational spectral band contours for the water molecule are computed in the simplest rigid rotor, normal mode approximation. Quantum techniques, are used to calculate the necessary potential energy, dipole moment, and polarizability information at the equilibrium geometry. A new quick, accurate, and easy to program classical technique involving no reference to Euler angles or special functions is developed to compute the infrared and Raman angles or special functions is developed to compute the infrared and Raman band contours for any rigid rotor, including asymmetric tops. A second, or simultaneous, type of ab initio approach is suggested for large systems, particularly those for which normal mode analysis is inappropriate, such as liquids, clusters, or floppy molecules. GRA

N83-16145# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A BRIEF HISTORY OF PHYSICS IN CHINA
Dai Nian-Zao 31 Aug. 1982 26 p refs Transl. into ENGLISH from Wuli (China), v. 10, no. 12, Dec. 1981 p 753-760
(AD-A119848; FTD-ID(RS)T-0753-82) Avail: NTIS HC A03/MF A01 CSCL 20/12

A brief history of physics in China is presented. Author

N83-16146# Helsinki Univ. (Finland). Research Inst. for Theoretical Physics.
PHASE TRANSITION OF SU(3) GAUGE THEORY AT FINITE TEMPERATURE
K. Kajantie, C. Montonen, and E. Pietarinen 1981 11 p refs
(HU-TFT-81-8) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

We present evidence for the presence of a phase transition in SU(3) lattice gauge theory at finite temperature using Monte Carlo methods. An extrapolation to the continuum limit leads to the value T sub(c) = lambda sub(mom) + 15% for the critical temperature separating the two phases. DOE

N83-16147# Association Euratom-CEA, Grenoble (France).
ANALYTIC SOLUTION OF THE TWO-DIMENSIONAL FOKKER-PLANCK EQUATION GOVERNING STOCHASTIC ION HEATING BY A LOWER HYBRID WAVE
G. Malescio Apr. 1981 20 p refs
(EUR-CEA-FC-1098) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The two-dimensional Fokker-Planck equation describing the ion motion in a coherent lower hybrid wave above the stochasticity threshold is analytical solved. An expression is given for the steady state power dissipation. DOE

N83-16148# Brookhaven National Lab., Upton, N. Y.
NEW COMPUTATIONAL APPROACH FOR THE LINEARIZED SCALAR POTENTIAL FORMULATION OF THE MAGNETOSTATIC FIELD PROBLEM
James H. Bramble (Cornell Univ., Ithaca, N.Y.) and Joseph E. Pasciak 1981 6 p refs Presented at COMPUMAG Conf., Argonne, Ill., 14 Sep. 1981
(Contract DE-AC02-76CH-00016)
(DE82-002224; BNL-30152; AMD-879; CONF-810954-2) Avail: NTIS HC A02/MF A01

The linearized scalar potential formulation of the magnetostatic field problem is considered which involves a reformulation of the continuous problem as a parametric boundary problem. By the introduction of a spherical interface and the use of spherical harmonics, the infinite boundary condition can also be satisfied in the parametric framework. The reformulated problem is discretized by finite element techniques and a discrete parametric problem is solved by conjugate gradient iteration. This approach decouples the problem in that only standard Neumann type elliptic finite element systems on separate bounded domains need be solved. The boundary conditions at infinity and the interface conditions are satisfied during the boundary parametric iteration. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environment Pollution.*

N83-16149*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EMPIRICAL SOURCE NOISE PREDICTION METHOD WITH APPLICATION TO SUBSONIC COAXIAL JET MIXING NOISE
William E. Zorumski and Donald S. Weir (Kentron International, Inc., Hampton, Va.) Dec. 1982 77 p refs
(NASA-TP-2084; L-15382; NAS 1.60:2084) Avail: NTIS HC A05/MF A01 CSCL 20A

A general empirical method, developed for source noise predictions, uses tensor splines to represent the dependence of the acoustic field on frequency and direction and Taylor's series to represent the dependence on source state parameters. The method is applied to prediction of mixing noise from subsonic circular and coaxial jets. A noise data base of 1/3-octave-band sound pressure levels (SPL's) from 540 tests was gathered from three countries: United States, United Kingdom, and France. The SPL's depend on seven variables: frequency, polar direction angle, and five source state parameters: inner and outer nozzle pressure ratios, inner and outer stream total temperatures, and nozzle area ratio. A least-squares seven-dimensional curve fit defines a table of constants which is used for the prediction method. The resulting prediction has a mean error of 0 dB and a standard deviation of 1.2 dB. The prediction method is used to search for a coaxial jet which has the greatest coaxial noise benefit as compared with an equivalent single jet. It is found that benefits of about 6 dB are possible. Author

N83-16150*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRCRAFT NOISE PREDICTION PROGRAM USER'S MANUAL
Ronnie E. Gillian 1982 323 p refs
(NASA-TM-84486; L-15064; NAS 1.15:84486) Avail: NTIS HC A14/MF A01 CSCL 20A

The Aircraft Noise Prediction Program (ANOPP) predicts aircraft noise with the best methods available. This manual is designed to give the user an understanding of the capabilities of ANOPP and to show how to formulate problems and obtain solutions by using these capabilities. Sections within the manual document basic ANOPP concepts, ANOPP usage, ANOPP functional modules, ANOPP control statement procedure library, and ANOPP permanent data base. appendixes to the manual include information on preparing job decks for the operating systems in use, error diagnostics and recovery techniques, and a glossary of ANOPP terms. S.L.

N83-16151*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

REDUCTION OF HIGH-SPEED IMPULSIVE NOISE BY BLADE PLANFORM MODIFICATION OF A MODEL HELICOPTER ROTOR

David A. Conner and Danny R. Hoad Dec. 1982 61 p refs Prepared in cooperation with Army Aviation Research and Development Command, Hampton, Va.

(DA Proj. 1L1-61102-AH-45)

(NASA-TM-84553; L-15511; NAS 1.15:84553; AVRADCOM-TR-82-B-6) Avail: NTIS HC A04/MF A01 CSCL 20A

The reduction of high speed impulsive noise for the UH-1H helicopter was investigated by using an advanced main rotor system. The advanced rotor system had a tapered blade planform compared with the rectangular planform of the standard rotor system. Models of both the advanced main rotor system and the UH-1H standard main rotor system were tested at 1/4 scale in the 4 by 7 Meter Tunnel. In plane acoustic measurements of the high speed impulsive noise demonstrated that the advanced rotor system on the UH-1H helicopter reduced the high speed impulsive noise by up to 20 dB, with a reduction in overall sound pressure level of up to 5 dB. S.L.

N83-16152*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTS ON HIGH BYPASS INTERNAL MIXER NOZZLE JET NOISE

Jack H. Goodykoontz Dec. 1982 23 p refs

(NASA-TM-83020; E-1456; NAS 1.15:83020) Avail: NTIS HC A02/MF A01 CSCL 20A

Model scale jet noise data are presented for a variety of internal lobed mixer nozzle configurations for take off power settings in a static environment. The results are presented for a 17.5 cm diameter fan nozzle to show the effect on noise levels caused by changes in geometric shape of the internal, or core flow, nozzle. The geometric variables include the lobe discharge angle, the number of lobes, spacing between the center plug and lobe valley, lobe side wall shape and axial contour of the lobes. An annular plug core flow nozzle was also tested and is used as a baseline for comparative purposes. Comparison of data from the internal lobed configurations showed that for comparative effect, in terms of the effect on full scale perceived noise levels, was caused by a change in the lobe discharge angle. The results showed that increasing the discharge angle caused an increase as large as 7 dB in sound pressure levels in the high frequency portion of the spectra. Changes in the other geometric variables cause negligible effects. Author

N83-16153*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF COMBUSTION SPECTRA CONTAINING ORGAN PIPE TONE BY CEPSTRAL TECHNIQUES

J. H. Miles and C. A. Wasserbauer 1982 29 p refs Presented at the 104th Meeting of the Acoustical Soc. of Am., Orlando, Fla., 8-12 Nov. 1982

(NASA-TM-83034; E-1472; NAS 1.15:83034) Avail: NTIS HC A03/MF A01 CSCL 20A

Signal reinforcements and cancellations due to standing waves may distort constant bandwidth combustion spectra. Cepstral techniques previously applied to the ground reflection echo problem are used to obtain smooth broadband data and information on combustion noise propagation. Internal fluctuating pressure measurements made using a J47 combustor attached to a 6.44 m long duct are analyzed. Measurements made with Jet A and hydrogen fuels are compared. The acoustic power levels inferred from the measurements are presented for a range of low heat release rate operating conditions near atmospheric pressure. For these cases, the variation with operating condition of the overall acoustic broadband power level for both hydrogen and Jet A fuels is consistent with previous results showing it was proportional to the square of the heat release rate. However, the overall acoustic broadband power level generally is greater for hydrogen than for Jet A. S.L.

N83-16154# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamic Environment Branch.

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 155. CH-3 IN-FLIGHT CREW NOISE

Harald K. Hille Sep. 1982 18 p ref 155 Vol.

(AF Proj. 7231)

(AD-A120791; AMRL-TR-75-50-Vol-155) Avail: NTIS HC A02/MF A01 CSCL 01/2

The CH-3 is a USAF tactical combat transport helicopter. This report provides measured data defining the bioacoustic environments at flight crew/passenger locations inside this helicopter during normal flight operations. Data are reported for nine locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C weighted and A weighted sound levels, preferred speech interference level, perceived noise levels and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Refer to Volume 1 of this handbook, USAF Bioenvironmental Noise Data handbook, Vol. 1: Organization, Content and Application, AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. GRA

N83-16155# Wayne State Univ., Detroit, Mich. Dept. of Physics.

PHOTOACOUSTIC MICROSCOPY ***Final Report, 16 Aug. 1981 - 15 Aug. 1982***

R. L. Thomas, L. D. Favro, and P. K. Kuo 14 Sep. 1982 5 p refs

(Contract DAAG29-81-K-0113)

(AD-A119903; ARO-18196.1-MS) Avail: NTIS HC A02/MF A01 CSCL 09/2

Considerable improvements have been achieved in the design of the photoacoustic microscope, including new sample cells, and better microcomputer hardware, firmware, and software for the scan control and data acquisition. The ND:YAG laser system has been made operational and has been used to obtain preliminary data in the development of a time-domain photoacoustic microscope (pulse-echo termal wave imaging). Scan control instrumentation has been developed for this instrument, as well as electronics for data acquisition in the time domain. Theoretical calculations of pulsed thermal wave propagation and scattering have been carried out for comparison with experiment. Calculations for photoacoustic signals (CW) from model subsurface defects have carried out and compared with experimental results. A key result is the theoretical prediction, and experimental verification that closed subsurface lateral cracks have a very characteristic photoacoustic phase signature which allows their discrimination from subsurface voids (or open cracks). Calculations have also been carried out for subsurfaces spherical voids and tilted closed cracks. These calculations themselves were made possible because of our development of a very genera theorem for SPAM using gas-filled cells, which greatly simplifies the theoretical calculations of the effects of thermal wave scattering from arbitrarily shaped flaws in solids. GRA

N83-16156# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 157: KC-10A IN-FLIGHT CREW NOISE

Harald K. Hille Sep. 1982 18 p

(AF Proj. 7231)

(AD-A120507; AMRL-TR-75-60-Vol-157) Avail: NTIS HC A02/MF A01 CSCL 01/2

The KC-10A is a standard USAF tanker-transport aircraft with high-speed, high altitude refueling and long range transport capability. This report provides measured data defining the bioacoustic environments at flight crew/passenger locations inside this helicopter during normal flight operations. Data are reported for 24 locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level,

perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Refer to Volume 1 of this handbook, USAF Bioenvironmental Noise Data Handbook, Vol. 1: Organization, Content and Application, AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. GRA

N83-16157# Naval Research Lab., Washington, D. C. Materials Section.
DYNAMIC ELASTIC CONSTANT DETERMINATION VIA MEASUREMENT OF THE ACOUSTIC FIELD SCATTERED BY A SPHERICAL ELASTOMER: THEORY Interim Report
Jean C. Piquette 15 Sep. 1982 38 p refs
(SF11121604)
(AD-A120418; NRL-MR-4873) Avail: NTIS HC A03/MF A01 CSCL 20/1

A technique is presented whereby dynamic elastic constants may be calculated by solving the inverse scattering problem of an infinite plane wave incident on a spherical elastomer. A least-squares approach is used to find the best values for the elastic constants that are consistent with measured scattered pressures. Relationships are provided that allow approximate calculation of the bulk and shear moduli to be performed using only the first few scattering constants. Difficulties and limitations in experimentally implementing the method herein described are discussed, and potential resolutions of these difficulties are presented. Author (GRA)

N83-16158# Naval Postgraduate School, Monterey, Calif. Dept. of Engineering Acoustics.
MEASUREMENTS OF THE HORIZONTAL DIRECTIONALITY OF THE AMBIENT ACOUSTIC NOISE IN MONTEREY BAY, CALIFORNIA M.S. Thesis
Michael Joseph Gagliardi Mar. 1982 116 p refs
(AD-A120450) Avail: NTIS HC A06/MF A01 CSCL 20/1

Measurements of some of the horizontal characteristics of acoustic ambient noise were carried out in the south-eastern parts of Monterey Bay, California, at a limited number of stations and for a limited number of ambient conditions. Directional hydrophones on buoys located at ranges of two to four miles from shore were used which have a steerable, cardioid-shaped pattern. The beam was successively aimed along the four cardinal directions and the frequency spectrum of the output was obtained. The frequency range of the system response was from 10 to 2500 Hz. Results are presented in the form of differences between the spectral energy bins in each direction and the average over all directions. Experimental difficulties with sonobuoy reliability prevented collection of extensive data. Some tentative conclusions are drawn from the results. Author (GRA)

N83-16159# Atomic Energy Research Establishment, Harwell (England). Materials Physics Div.
THE PROPAGATION OF ULTRASOUND IN POROUS MEDIA
C. M. Sayers and R. L. Smith Nov. 1981 18 p refs
(AERE-R-10359) Avail: NTIS HC A02/MF A01

Equations describing the propagation of ultrasound in two phase materials are solved numerically for porous solids, and are found to give unphysical results for high porosity. A self consistent theory which can be solved analytically is presented and is shown to have reasonable behavior at high porosity. Author

N83-16160# Atomic Energy Research Establishment, Harwell (England). Metallurgy Div.
QUANTITATIVE ACOUSTIC EMISSION STUDIES DURING DEFORMATION AND FRACTURE: A REVIEW
H. N. G. Wadley and C. B. rpn AERE-R-10353 Scruby Dec. 1981 55 p refs
Avail: NTIS HC A04/MF A01

The basic physical processes involved in the generation and propagation of elastic waves in metals undergoing deformation and fracture is reviewed. It is shown that for dislocation motions, the product of propagation distance and velocity must exceed a critical level for detectable signals to be generated. For crack growth under mode I loading the detectability criterion is that the product of the stress, crack advance area and crack advance speed must exceed a critical value. These criteria are used to analyze acoustic emission results from well characterized metals. The review then considers the problem of characterizing detected acoustic emission sources. It is shown that recent developments have enabled crack advances of as little as 20 micrometers to be measured in the laboratory and the potential exists to improve this to 1-2 micrometers. Author

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N83-16161# Scripps Institution of Oceanography, La Jolla, Calif. Marine Physical Lab.
EFFECT OF IONIC STRENGTH AND ION PAIRING ON SOUND ABSORPTION IN AQUEOUS SOLUTIONS OF MgSO4 AND NaCl Summary Report
C. Neuberger, C. C. Paul Hsu, and F. H. Fisher 15 Apr. 1982 16 p refs
(Contract N00014-79-C-0472; Grants NSF OCE-78-04844; NSF OCE-78-25123)
(AD-A120699; MPL-U-56/78; SIO-REF-82-9) Avail: NTIS HC A02/MF A01 CSCL 20/8

Sound absorption in aqueous solutions of MgSO4 is reduced by the addition of NaCl. From the Eigen and Tamm multistate dissociation theory it can be shown that the absorption exhibited by MgSO4 is proportional to the ion-pair concentration. The reduction in sound absorption observed upon the addition of NaCl is treated theoretically and is attributed to two effects; formation of NaSO4 and MgCl(+) ion-pairs and an increase in ionic strength, both of which reduce the concentration of MgSO4 ion pairs. Comparisons between theory and experiment support the theoretical treatment presented. For 0.02 molar MgSO solutions with the addition of up to 0.12 molar NaCl, the theory is in good agreement with the data of Hsu and Fisher and in substantial conflict with the data in 0.17 molar MgSO4 mixtures with NaCl of Kurtze and Tamm. For 0.1 and 0.17 molar MgSO4 solutions, the data of Kurtze and Tamm are in better agreement with theory. The extension to high ionic strength of Debye-Huckel theory derived for low ionic strength is discussed briefly. Author (GRA)

N83-16162# Hughes Research Labs., Malibu, Calif.
DIRECT WRITE ION LITHOGRAPHY Final Technical Report, 18 Sep. 1979 - 17 Mar. 1982
W. M. Clark, Jr., C. H. McKenna, and R. L. Seliger Hanscom AFB, Mass. RADC Jul. 1982 43 p refs
(Contract F19628-79-C-0181; AF Proj. 2305)
(AD-A120672; RADC-TR-82-195) Avail: NTIS HC A03/MF A01 CSCL 20/8

An ion focusing column has been designed to produce a focused beam of 320-keV Si(++) ions for use in direct-write ion lithography. Reasons for the choice to use 320-keV Si(++) ions for resist exposure are presented. Details of the column design are described, including a two-lens mass separating geometry, which will produce an on-axis focused ion spot of 700 A diameter and a scanfield of 1 mm x 1 mm with only a 2.5% increase in spot size. A detailed analysis is made of possible sources of aberration which contribute to spot size and it is shown that chromatic scan aberrations dominate. Two new techniques are described which could produce target and alignment mark images with a higher signal-to-noise ratio than is possible with present techniques of detecting secondary electrons using a channel-electron-multiplier. GRA

N83-16163# Tennessee Univ., Knoxville.
[STRUCTURE OF HIGHLY IONIZED HEAVY IONS AND ASSOCIATED COLLISION PHENOMENA IN THE MEV/NUCLEON

RANGE] Final Report, Apr. 1972 - Aug. 1982
Ivan A. Sellin Oct. 1982 19 p refs
(Contract N00014-75-C-0474)
(AD-A120824; Rept-8201) Avail: NTIS HC A02/MF A01 CSCL 20/8

This document is the final report associated with work performed on the project entitled "Structure of Highly Ionized Heavy Ions and Associated Collision Phenomena in the MeV/Nucleon Range.' GRA

N83-16164# Birmingham Univ. (England). Dept. of Space Research.
ION-ION NEUTRALIZATION Final Scientific Report, 1 Oct. 1980 - 31 Jan. 1982
David Smith and Nigel G. Adams 31 May 1982 56 p refs
(Grant AF-AFOSR-3260-77; AF Proj. 2310; AF Proj. 2303)
(AD-A119881; AFGL-TR-82-0202) Avail: NTIS HC A04/MF A01 CSCL 20/8

A variable-temperature FALP/SIFT apparatus has been built which combines the essential features of the versatile Flowing Afterglow/Langmuir Probe (FALP) and Selected Ion Flow Tube (SIFT) apparatuses. It has been used to determine the coefficients for the recombination reactions of NO+ and 02+ ions with electrons over the temperature range 200-600 K and for the attachment reactions of SF6, CC14 and C12 with electrons at 300 K. The results of these studies are reported and are shown to resolve some of the differences which are apparent between the result of previous studies of some of these reactions. A reassessment, based on laboratory data, of the ion-ion recombination coefficients appropriate to the stratosphere is also presented and the new values are in good agreement with those derived from in-situ stratospheric observations by other workers.
Author (GRA)

N83-16165# Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry.
ELECTRONIC EXCITATION IN MOLECULAR COLLISIONS: STRUCTURAL, DYNAMIC AND KINETIC CONSIDERATIONS Annual Summary Report, Sep. 1981 - Aug. 1982
R. D. Levine Aug. 1982 10 p refs
(Grant N00014-78-G-0036)
(AD-A119902; ASR-4) Avail: NTIS HC A02/MF A01 CSCL 20/8

The factors governing chemical reactivity with special reference to the role of electronic energy in promoting the reaction and to the production of electronically excited species are examined. The problem is studied both in general terms (i.e., the development of the required theoretical framework) and in application to specific systems. GRA

N83-16166# Block Engineering, Inc., Cambridge, Mass.
NITROGEN-14 NQR STUDY OF ENERGETIC MATERIALS Final Report, 12 Feb. 1979 - 31 Jul. 1982
Robert A. Marino, Raymond F. Connors, and Lawrence Leonard Sep. 1982 176 p refs
(Contract DAAG29-79-C-0025)
(AD-A119844; BE-82-949; ARO-15556.4-PH) Avail: NTIS HC A09/MF A01 CSCL 20/8

The complete nitrogen-14 NQR Spectrum of TNT was obtained for both the stable Phase (monoclinic) and the unstable (orthorhombic) phase. It was established that quadrupole coupling data are very sensitive to and can yield a measure of the angle of twist of the plane of the NO2 group away from the plane of the benzene ring about the CN bond. For the high explosive 1,3,5,7-tetranitro-1,3,5,7-tetraazacyclooctane (HMX), an analysis of the Nitrogen-14 NQR Spectrum and its temperature dependence yield details of the motion of the molecule in the solid. The Nitrogen-14 NQR Spectrum of RDX at 77 K was also reported. Finally, two instrumentation advances were made. A New pulse sequence, labelled SORC for Strong-Off-Resonant Comb of RF pulses, was introduced and some of its properties were studied. In addition, moved by a desire to display as much as possible of the crowded NQR spectrum of TNT as possible, Fourier transform techniques were extended to obtain close to an order-of-magnitude increase in the breadth of the spectrum displayed in a single Fourier transform.
Author (GRA)

N83-16167# Connecticut Univ., Storrs. Dept. of Physics.
COLLISION STUDIES ON MULTIPLY CHARGED IONS Final Report, 14 Jul. 1981 - 30 Jun. 1982
Edward Pollack Oct. 1982 22 p refs
(Contract DAAG29-81-K-0141)
(AD-A120430; ARO-18613.2-PH) Avail: NTIS HC A02/MF A01 CSCL 20/8

Gaseous discharges contain ions in a number of charge states. Collisions between these ions and atoms in the discharge result in the production of excited ions and atoms as well as free electrons. Single electron capture collisions involving doubly charged ions with atoms are particularly important in determining the behavior of the discharge since they result in two ions with one generally in an excited state. Such collisions are not well understood. In this context we have studied electron capture in Ar(2+) + Ar because of the importance of argon as a discharge gas and because there were substantial difficulties in understanding single electron capture processes in the collision. Our laboratory has measured the cross sections for the important final channels in the single electron capture collisions as well as the direct scattering and for the double electron capture cases. It is particularly interesting that the direct scattering does not occur with Ar target excitation as was found in Ar(+) + Ar. We have also shown that long lived highly excited states of Ar(2+) make important contributions to the charge exchange. We interpret our results and propose a simple model of the collision. GRA

N83-16168# California Univ., Livermore. Lawrence Livermore Lab.
TAMPERED, SPLIT FUEL-LAYER ION-BEAM TARGET
D. J. Meeker and R. O. Bangerter 1981 10 p refs Presented at 4th Intern. Topical Conf. on High-Power Electron and Ion-Beam Res. and Technol., Palaiseau, France, 29 Jun. - 3 Jul. 1981 Submitted for publication
(Contract W-7405-eng-48)
(DE81-001684; UCRL-85716; CONF-810620-19) Avail: NTIS HC A02/MF A01

A double shelled, split fuel layer target with an outer hydro tamper surrounding the low Z absorber has been designed for ion beam drivers. Results from 1-D computer calculations predict a 5 GeV heavy ion beam could produce gains in excess of 200. The behavior of this target as a function of ion range, tamper thickness and spot size has been studied. DOE

N83-16169# Los Alamos Scientific Lab., N. Mex.
ALPHA DECAY SELF-DAMAGE IN CUBIC AND MONOCLINIC ZIRCONOLITE
F. W. Clinard, Jr., C. C. Land, D. E. Peterson, D. L. Rohr, and R. B. Roof 1981 9 p refs Presented at the Intern. Symp. on the Sci. Basis for Nucl. Waste Management, Boston, 16-19 Nov. 1981 Submitted for publication
(Contract W-7405-eng-36)
(DE82-002400; LA-UR-81-2954; CONF-811122-7) Avail: NTIS HC A02/MF A01

Samples of primarily monoclinic (238)Pu-doped zirconolite were stored at ambient temperature to allow accumulation of alpha decay self damage to a dose of 1 x 10 to the 24th alpha cu m. Bulk swelling reached 2.3 vol% with no tendency toward saturation, a damage response similar to that observed for cubic Pu-doped zirconolite. X-ray volumetric swelling at 4 x 10 to the 24th alpha cu m was 1 vol%, considerably less than that for the cubic material. Changes in cell dimensions differed significantly from those reported by others for a monoclinic natural mineral. Extensive microcracking was observed, and is attributed at least partially to swelling differences between the matrix and minor phases. DOE

N83-16170# Massachusetts Inst. of Tech., Cambridge. Nuclear Reactor Lab.
SCOPING EXPERIMENT TO INVESTIGATE THE EFFECTS OF

SIMULTANEOUS MULTI-ENERGY ION BOMBARDMENT, NEUTRON IRRADIATION AND STRESS/TEMPERATURE CYCLING ON 316 SS

H. Andresen, G. Kohse, A. S. Argon, and O. K. Harling 1981 5 p refs Presented at Fusion Reactor Mater. Meeting, Seattle, 9 Aug. 1981

(Contract DE-AS02-78ET-52027)

(DE82-000645; DOE/ET-52027/2; CONF-810831-60) Avail: NTIS HC A02/MF A01

The simulation of the aspects of fusion reactor first wall environment - stress and temperature cycling and multienergy ion bombardment - is described. A 316 SS pressure capsule which was cycled 14,000 times while accumulating a dose of approximately 10 to the 23 power He and Li ions sq m is compared to a nonion bombarded control capsule which was cycled 16,000 times under similar conditions. The ion damaged sample was found to have approximately four times as many short surface cracks as the control sample at the region of maximum stress. Although no evidence of such cracks penetrating beyond the ion implanted surface layer was found, further experiments carried to higher doses and more cycles are considered necessary to fully determine the effects of such layers on first wall lifetimes. DOE

N83-16171# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

POSSIBLE TEST OF CP INVARIANCE IN NEUTRINO OSCILLATIONS

S. M. Bilenky and F. Niedermayer 1981 8 p refs

(JINR-E-2-81-47) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

A method is proposed for testing CP invariance in neutrino oscillations. The method is based on the comparison (at some distance from source) of fluxes of neutrinos and antineutrinos obtained from Ksub(L) decays. It is shown that in the case when properly normalized differences of neutrino and antineutrino fluxes are nonvanishing, their measurement would allow one to test CPT invariance and to get information on the number of neutrino types. DOE

N83-16172# Science Research Council, Chilton (England).

POLARISATION ANALYSIS OF ELASTIC NEUTRON SCATTERING USING A FILTER SPECTROMETER ON A PULSED SOURCE

J. Mayers and W. G. Williams May 1981 22 p refs

(RL-81-047) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The experimental and theoretical aspects of the polarization analysis technique in elastic neutron scattering are described. An outline design is presented for a filter polarization analysis spectrometer on the Rutherford Laboratory Spallation Neutron Source and estimates made of its expected count rates and resolution. DOE

N83-16173# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.

EXCITATION CROSS SECTIONS OF HYDROGEN RELEVANT TO NEUTRAL-BEAM DIAGNOSTICS

Y. K. Bae, C. F. Burrell, and R. H. MacFarland Sep. 1981 6 p refs Presented at the Am. Vacuum Soc. Natl. Symp., Anaheim, Calif., 2-6 Nov. 1981

(Contract W-7405-eng-48)

(DE82-001971; LBL-13313; CONF-811113-28) Avail: NTIS HC A02/MF A01

The excitation of H atom projectiles and dissociation of H(2+) and H(3+) projectiles into the 3p or 3d states of the H atom were measured. The collisional destruction cross section for the n = 3 levels in the energy range between 40 and 120 keV were also measured. DOE

N83-16174# State Univ. of New York, Stony Brook. Dept. of Chemistry.

STABLE ISOTOPE STUDIES Annual Progress Report, 1 Mar. 1981 - 28 Feb. 1982

Takanobu Ishida 23 Oct. 1981 151 p refs

(Contract DE-AC02-80ER-10612)

(DE82-002932; DOE/ER-10612/6) Avail: NTIS HC A08/MF A01

Research discussed cover; (1) cryogenic measurements of vapor pressure isotope effects (VPIE) in CHF3, CH2F2, CH3F, and ammonia; (2) interpretations of the results of the VPIE studies of CHF3 and CH3F by means of ab initio molecular orbital calculations and vibrational analyses; (3) studies of nitrogen isotope fractionation by an exchange between nitric oxide and the liquid phase consisting of N2O3 and N2O4 under elevated pressures; (4) an exploration of the concept of closed refluxer system for the Nitrox process for separating N-15 using a Fe(II)/Fe(III) system as reducing agent for nitric acid and the electrolysis for regeneration of Fe(II); and (5) a theoretical study of approximation of the zero-point energy and its isotopic differences developed on the basis of Lanczos' tau-method. DOE

N83-16175# California Univ., Livermore. Lawrence Livermore Lab. Physics, Computer Science and Mathematics Div.

SMALL ANTI THETA AND AN INVISIBLE AXION AS AUTOMATIC CONSEQUENCES OF GRAND UNIFICATION

Lawrence J. Hall Sep. 1981 15 p refs Presented at 1981 Banff Summer Inst. on Particles and Fields, Calgary, Alberta, 16-28 Aug. 1981 Submitted for publication

(Contract W-7405-eng-48)

(DE82-001937; LBL-13328; CONF-810882-1) Avail: NTIS HC A02/MF A01

The possibility is explored of solving the strong CP problem in a grand unified theory in which a global Peccei-Quinn symmetry is an automatic consequence of the gauge structure. The low energy effective theory differs from that of the standard model only by the presence of an extremely light, weakly interacting axion. DOE

N83-16176# Brookhaven National Lab., Upton, N. Y.

E2 TRANSITIONS IN DEFORMED NUCLEI AND THE IBA

D. D. Warner and R. F. Casten 1981 9 p refs Presented at the 4th Intern. Symp. on Neutron-Capture Gamma-ray Spectroscopy and Related Topics, Grenoble, France, 7 Sep. 1981

(Contract DE-AC02-76CH-00016)

(DE82-002015; BNL-30174; CONF-810920-16) Avail: NTIS HC A02/MF A01

The mechanism which determines the relative E2 strengths in the interacting boson approximation is studied. The structure of the E2 operator necessary to reproduce the empirical B(E2) values in deformed even-even nuclei in the rare earth region is investigated. DOE

N83-16177# California Univ., Livermore. Lawrence Livermore Lab.

INFLUENCE OF TARGET REQUIREMENTS ON THE PRODUCTION, ACCELERATION, TRANSPORT AND FOCUSING OF ION BEAMS

Roger O. Bangerter, James W. K. Mark, Donald J. Meeker, and David L. Judd (California Univ., Berkeley) 1981 9 p refs Presented at 4th Intern. Topical Conf. on High-Power Electron and Ion-Beam Res. and Technol., Palaiseau, France, 29 Jun. - 3 Jul. 1981 Submitted for publication

(Contract W-7405-eng-48)

(DE82-001675; UCRL-85717; CONF-810620-17) Avail: NTIS HC A02/MF A01

The energy gain of ion-driven fusion targets as a function of input energy, ion range, and focal spot radius was calculated. For heavy-ion drivers a given target gain, together with final-lens properties, determines a 6-D phase space volume which must exceed that occupied by the ion beam. Because of Liouville's theorem and the inevitability of some phase space dilutions, the beam's 6-D volume will increase between the ion source and the target. This imposes important requirements on accelerators and on transport and focusing systems. DOE

N83-16178# Brookhaven National Lab., Upton, N. Y.

RECENT RESULTS FROM BNL NEUTRINO EXPERIMENTS AND

PLANS FOR THE FUTURE
M. J. Murtagh 1981 24 p refs Presented at the Inter. Conf. on Neutrino Phys. and Astrophys., Maui, Hawaii, 1 Jul. 1981
(Contract DE-AC02-76CH-00016)
(DE82-001815; BNL-30082; CONF-810767-2) Avail: NTIS HC A02/MF A01

Recent results on neutrino scattering from experiments in the wide band neutrino beam at Brookhaven are discussed. There are recent 7 BC measurements on quasi-elastic scattering and charged current total cross sections and charged current neutron to proton cross section ratios. Final results from two counter experiment measurements of anti p elastic scattering are presented. Present and future activity at Brookhaven is outlined. DOE

N83-16179# Helsinki Univ. (Finland). Research Inst. for Theoretical Physics.
BOUND STATE PROBLEM AND QUARK CONFINEMENT
M. Chaichian, A. P. Demichev (Moscow State Univ.), and N. F. Nelipa (Moscow State Univ.) 1980 12 p refs
(HU-TFT-80-35; ISBN-951-45-2098-X) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

A quantum field-theoretic model in which quark is confined is considered. System of equations for the Green functions of color singlet and octet bound states is obtained. The method is based on the nonperturbative Schwinger-Dyson equations with the use of Slavnov-Taylor identities. It is shown that in the framework of the model if there exist singlet, then also exist octet bound states of the quark-antiquark system. Thus in general, confinement of free quarks does not mean absence of their colored bound states. DOE

N83-16180# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij.
PARAMETERIZATION OF PARTON DECAY FUNCTIONS
S. S. Grigoryan 1980 5 p refs In ENGLISH; RUSSIAN summary Submitted for publication
(IFVE-OTF-80-157) Avail: NTIS (US Sales Only) HC A02/MF A01;DOE Depository Libraries

Parton decay functions (PDF) characterizing the decay probability in the lowest order of the perturbation theory in the framework of quantum chromodynamics are considered. A simple parameterization for PDF is proposed. The parameterization describes also PDF in the theory with spinor quarks and (pseudo)scalar gluons. It is concluded that the existence of parametrization is not casual. DOE

N83-16181# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
CERAMIC TO METAL BRAZED RECTANGULAR INSULATOR FOR NEUTRAL BEAM ACCELERATORS
J. A. Paterson, G. W. Koehler, and D. P. Yee Oct. 1981 4 p refs Presented at the 9th Symp. on Eng. Probl. of Fusion Res., Chicago, 26-29 Oct. 1981
(Contract W-7405-eng-48)
(DE82-003624; LBL-13513; CONF-811040-122) Avail: NTIS HC A02/MF A01

The details of the manufacturing processes used to fabricate a vacuum tight Alumina to Titanium brazed rectangular insulator structure are presented. The specifics of component cleaning procedures are given and the brazing cycle chosen is described. General precautions and techniques that should be used for similar applications are discussed. The insulator assembly is a weldment of modular brazed sections and is to be the supporting structure for the water cooled molybdenum grids of an Advanced Positive Ion Source. DOE

N83-16182# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
EVIDENCE FOR A NARROW BARYON AT 1.95 GeV/c2
A. N. Aleev, V. A. Arefiev, V. P. Balandin, V. K. Birulev, T. S. Grigalashvili, B. N. Gushkov, I. M. Ivanchenko, N. N. Karpenko, D. A. Kirillov, V. G. Krivokhizhin et al 1980 12 p refs In ENGLISH; RUSSIAN summary Prepared in cooperation with Tbilisi State Univ. and the Bulgarian Academy of Sciences and the Academy of Sciences, Tbilisi Submitted for publication
(JINR-E-1-80-726) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The search for new narrow baryon resonances produced by neutrons at 40 GeV/c on a carbon target is carried out. A narrow peak is seen at 1.95 GeV/C squared. A possible interpretation of the peak is the existence of a narrow baryon resonance with a mass of 1.95 GeV/C squared and width of 0.015 GeV/C squared which has a decay mode N(*) yields sigma (1385-*) + K(+).DOE

N83-16183# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy
STUDY OF PION PRODUCTION IN 4.5 GeV/c PER NUCLEON 4He INTERACTIONS WITH NUCLEAR TARGETS, SKM-200 COLLABORATION
A. U. Abdurakhimov, M. K. Anikina, V. S. Butsev, E. A. Dementiev, N. S. Glagoleva, A. I. Golokhvastov, L. A. Goncharova, A. G. Grachov, S. V. Kadykova, N. I. Kaminsky et al 1980 18 p refs In ENGLISH; RUSSIAN summary Prepared in cooperation with the Academy of Sciences, Tbilisi and the Academy of Sciences, Alma-Ata and the Academy of Sciences, Moscow and Warsaw Univ. and Tbilisi State Univ. Submitted for publication
(JINR-E-1-80-598) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Inelastic interactions have been studied of (4)He nuclei, at an incident momentum of 4.5 GeV/c per nucleon, with pure Li, C, Al, Cu and Pb targets using the SKM-200 streamer chamber. Cross sections and their dependence on the target mass number for fragmentation processes have been obtained. The multiplicities, transverse momenta and rapidities of negative pions as well as their correlations have been analyzed separately for central and peripheral collisions. The results are shown to be qualitatively inconsistent with predictions derived from the minimal version of coherent tube model. They are also in quantitative disagreement with predictions of internuclear cascade model. DOE

N83-16184# Atomic Energy Research Establishment, Harwell (England). Materials Physics Div.
SMALL ANGLE NEUTRON SCATTERING (SANS) FROM HEAT TREATED PE16 SPECIMENS FROM BERKELEY NUCLEAR LABORATORIES
Colin G. Windsor and Vic S. Rainey Jun. 1982 31 p refs
(AERE-R-10523) Copyright. Avail: Issuing Activity

Results are presented on the small angle neutron scattering from a set of 12 PE16 nickel based super alloy specimens. They include a solution treated and quenched specimen and samples heat treated to 700 C for times between 16 and 10,000 hours. The quenched specimen showed some scattering from particles of up to 24 nm diameter. This was assumed to be from carbide precipitates present in all specimens. The effects of heat treatment were therefore deduced by subtracting quenched specimen results from those of the heat treated specimens. All heat treated specimens show a further prominent precipitate. It can be identified as arising from the gamma' Ni3(Ti,Al) precipitate from its mean size, which grows roughly as the cube of the heat treatment time, reaching a mean diameter of 35 nm at 500 hours. The precipitate volume fraction is less well determined because of the uncertainty in the precipitate atomic composition. It appears to have a value of order 9 + or - 1.5% roughly independent of the heat treatment time. A gamma' precipitate of the form Ni(0.75)Al(x)Ti(0.25-x) is assumed with x measured by energy dispersive electron microscopy. M.G.

N83-16185# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.
AN INVESTIGATION ON THE NATURE OF POROSITY IN HARDENED CEMENT PASTES USING SMALL ANGLE NEUTRON SCATTERING
D. Pearson Apr. 1982 21 p refs
(AERE-R-10531) Avail: NTIS HC A02/MF A01

The use of small angle neutron scattering for investigating the porosity and pore size distribution in hardened cement paste is

discussed. The technique enables information to be obtained at the fine end of the pore distribution (less than approximately 30 nm diameter) without any specimen drying or pretreatment. The technique indicates a bi-modal distribution of spherical or near spherical pores with diameters of approximately 5 nm and 10 nm, accounting for less than about two percent of the total paste volume. The pores seem relatively unaffected by the water to cement ratios investigated, however, drastic effects do seem to occur on drying at 105 C. M.G.

N83-15875# Brookhaven National Lab., Upton, N. Y.
RADIATION DAMAGE MEASUREMENTS ON NONMETALS MADE DURING IRRADIATION WITH 1 TO 3 MeV ELECTRONS Final Report
Paul W. Levy *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 12 p refs (For primary document see N83-15860 06-44)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A99/MF A01 CSCL 20H

N83-15879# Spire Corp., Bedford, Mass.
IN SITU MONITORING OF CRITICAL SYSTEM COMPONENT EROSION BY NUCLEAR ACTIVATION TECHNIQUES Final Report
F. L. Milder *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 14 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20H

N83-15884# Princeton Univ., N. J.
RECENT ADVANCES IN MOLECULAR DYNAMICS Final Report
Herschel Rabitz *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 34 p refs (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 07D

N83-16127# Academy of Sciences, Berlin (East Germany). Zentralinst. fuer Elektronenphysik.
NUMERICAL SIMULATION OF COLLECTIVE ION ACCELERATION
W. Hintze *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 105-106 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N83-16186# California Univ., Livermore. Lawrence Livermore Lab.
IMMOBILIZATION OF HIGH LEVEL NUCLEAR REACTOR WASTES IN SYNROC: A CURRENT APPRAISAL
V. M. Oversby and A. E. Ringwood 13 Oct. 1981 8 p refs Presented at the Ann. Meeting of the Mater. Res. Soc., Boston, 16-19 Nov. 1981
(Contract W-7405-eng-48)
(DE82-002579; UCRL-86786; CONF-811122-9) Avail: NTIS HC A02/MF A01

Results are presented for leach testing at 95 C and 200 C of SYNROC containing 9% and 20% simulated high level radioactive waste, synthetic hollandite and pervoskite samples, and natural zirconolite and pervoskite samples. Single phase synthetic minerals show much higher leach rates than natural mineral samples and polyphase SYNROC samples. Natural zirconolite samples with low radiation damage have leach rates at 200 C based on U which are identical to those measured on SYNROC samples. Natural zirconolites with very large accumulated alpha dose and radiation damage have leach rates at 200 C which are only 5 times higher than those of low dose samples. DOE

N83-16187# Australian Atomic Energy Commission, Lucas Heights.
WASTE DISPOSAL FROM THE LIGHT WATER REACTOR FUEL CYCLE
J. M.. Costello and C. J. Hardy May 1981 24 p refs Presented at the 51st ANSAAS Congr., Brisbane, 11-15 May 1981
(INIS-mf-6591; CONF-8105115-1) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Alternaive nuclear fuel cycles for support of light water reactors are described and wastes containing naturally occurring or artificially produced radioactivity reviewed. General principles and objectives in radioactive waste management are outlined, and methods for their practical application to fuel cycle wastes discussed. Management of wastes from upgrading processes of uranium hexafluoride manufacture and uranium manufacture and enrichment, and, to a lesser extent, nuclear power reactor wastes are discussed. Some estimates of radiological dose commitments and health effects from nuclear power and fuel cycle wastes were made for US conditions. These indicate that the major part of the radiological dose arises from uranium mining and milling, operation of nuclear reactors, and spent fuel reprocessing. However, the total dose from the fuel cycle is estimated to be only a small fraction of that from natural background radiation. DOE

N83-16188# Oak Ridge National Lab., Tenn.
OVERVIEW OF THE FUSION ENGINEERING DEVICE (FED) DESIGN
D. Steiner and C. A. Flanagan (Westinghouse Electric Corp., Oak Ridge, Tenn.) 1981 13 p refs Presented at the Meeting and Workshop on Fusion Reactor Design and Technol., Tokyo, 5 Oct. 1981
(Contract W-7405-eng-26)
(DE82-001438; CONF-811046-9) Avail: NTIS HC A02/MF A01

A fusion engineering device is described. The device has a major radius of 5.0 m with a plasma minor radius of 1.3 m elongated by 1.6. Capability is provided for operating the toroidal field coils up to 10 tesla (T), but the bulk of the operations are designed for 8 T. At 8-T conditions the fusion power is approximately 180 MW (neutron wall loading approximately 0.4 MW/meters squared) and a plasma Q of approximately 5 is expected. At 10-T conditions, which are expected to be limited to about 10% of the total operations, the fusion power is approximately 450 MW (approximately 1.0 MW/meters squared) and ignition is expected. DOE

N83-16189# Oak Ridge National Lab., Tenn.
NUCLEAR ENERGY IN PERSPECTIVE
D. B. Trauger 17 Sep. 1981 18 p refs Presented at Alpha Chi Omega Greensboro Coll. Symp., Greensboro, N.C., 17 Sep. 1981
(DE81-030815; CONF-810970) Avail: NTIS HC A02/MF A01

The author offers personal comments on what he feels is the current state of nuclear energy, and forecasts nuclear's role in the future. Touched on are: Three Mile Island; proliferation; and breeder technology. DOE

N83-16190# Atomic Energy Research Establishment, Harwell (England). Metallurgy Div.
REVIEW OF PROGRESS ON FUSION MATERIALS TECHNOLOGY, HARWELL, DECEMBER 1980. IRRADIATION EFFECTS IN FUSION REACTOR MATERIALS
D. R. Harries Mar. 1981 9 p refs
(DE81-700050; AERE-M-3170) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The evolution of the radiation damage structure, void and gas bubble swelling, and surface blistering effects in both model and potential first wall materials for a D-T fusion reactor system of the TOKAMAK type was investigated along with radiation effects in inorganic insulator materials. In addition, investigations were carried

out into the effects of irradiation on organic insulators and on the performance of rubber seals. The principal achievements are summarized and a list of 50 references is given. DOE

N83-16191# Science Research Council, Chilton (England).
STORAGE RING SYSTEM FOR HEAVY ION FUSION
N. M. King and J. R. M. Maidment Jan. 1981 8 p refs
(DE81-700019; RL-81-007) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Current approaches to designing heavy ion fusion demonstration plants based on radio frequency linacs and storage rings are discussed. Parameter frameworks include a useful input of 3 MJ and numbers of storage rings and beam lines in excess of the minimum to avoid the various space charger limitations. DOE

N83-16192# Sandia Labs., Albuquerque, N. Mex.
RADIOACTIVE WASTE DISPOSAL IN THE MARINE ENVIRONMENT
D. R. Anderson 1981 24 p Presented at Symp. on Eng. Aspects of Using the Assimilative Capacity of the Oceans, Lewes, Del., 22 Jun. 1981
(Contract DE-AC04-76DP-00789)
(DE82-002063; SAND-81-1414C; CONF-8106165) Avail: NTIS HC A02/MF A01

In order to find the optimal solution to waste disposal problems, it is necessary to make comparisons between disposal media. It has become obvious to many within the scientific community that the single medium approach leads to over protection of one medium at the expense of the others. Cross media comparisons are being conducted in the Department of Energy ocean disposal programs for several radioactive wastes. Investigations in three areas address model development, comparisons of laboratory tests with field results and predictions, and research needs in marine disposal of radioactive waste. Tabulated data are included on composition of liquid high level waste and concentration of some natural radionuclides in the sea. DOE

N83-16193# Combustion Engineering, Inc., Windsor, Conn.
ANALYSIS OF SELECTED CRITICAL EXPERIMENTS USING ENDF/B-IV AND ENDF/B-V DATA Final Report
U. N. Singh, J. R. Rec, and A. Jonsson Oct. 1981 32 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 978-1)
(DE82-900979; EPRI-NP-2076) Avail: NTIS HC A03/MF A01

Selected critical experiments - TRX 1 & 2 (U metal; BNL 1, 2, 3 (ThO2/U-233); and B & W TUPE 15B (ThO2/U-235) - were analyzed using ENDF/B-V data, and the results were compared to the measured parameters and to values obtained using ENDF/B-IV. Calculations were performed with DIT, an integral transport assembly design code. A heterogeneous cell calculation in 85 energy groups was performed for each configuration. Leakage was accounted for through B-1 calculation using the measured bucklings. Overall, ENDF/B-V data have been found to improve the agreement with experimental results with the exception of the TUPE 15B core. However, the changes in the capture cross sections of U-238 (epithermal) and Th-232 do not fully resolve the long-standing differences with the measurements. DOE

N83-16194# Commission of the European Communities, Luxembourg.
DUTCH GEOLOGIC RADIOACTIVE WASTE DISPOSAL PROJECT Final Report
J. Hamstra and B. Verkerk 1981 232 p refs
(DE81-700737; EUR-7151; ISBN-92-825-2292-X) Avail: NTIS (US Sales Only) HC A11/MF A01; DOE Depository Libraries

Geologic disposal of radioactive waste is reviewed. The radionuclide release consequences of an accidental flooding of the underground excavations was studied. The results of the quantitative examples made for different effective cross sections of the permeable layer connecting the mine excavations with the boundary of the salt dome are that under all circumstances the concentration of the waste nuclides in drinking water will remain well within the ICRP maximum permissible concentrations. Further analysis work was done on what minima can be achieved for both the maximum local rock salt temperatures at the disposal borehole walls and the maximum global rock salt temperatures halfway between a square of disposal boreholes. Different multilayer disposal configurations were analyzed and compared. DOE

N83-16195# Oak Ridge National Lab., Tenn.
USDOE ACTIVITIES IN LOW-LEVEL RADIOACTIVE WASTE TREATMENT
J. E. Vath 1981 19 p Presented at the Seminar on the Management of Radioactive Waste from Nucl. Power Plants, Karlsruhe (West Germany), 5 Oct. 1981
(Contract W-7405-eng-26)
(DE82-001450; IAEA-SR-57/42; CONF-811056-1) Avail: NTIS HC A02/MF A01

Current research, development and demonstration programs sponsored by the US Department of Energy in the area of low-level radioactive waste treatment are described. During the twelve month period ending September 30, 1981, 14 prime US Department of Energy contractors were involved with over 40 low-level radioactive waste disposal technology projects. Three specific projects or task areas were selected for discussion to illustrate new and evolving technologies, and application of technology developed in other waste management areas to low-level waste treatment. The areas to be discussed include a microwave plasma torch incinerator, application of waste vitrification, and decontamination of metal waste by melting. DOE

N83-16196# Department of Energy, Laramie, Wyo. Operations Office.
NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS QUALITY-ASSURANCE PROGRAM PLAN: MANAGEMENT AND OVERVIEW, REVISION 1
Oct. 1981 28 p refs
(DE82-002077; NVO-196-18-Rev-1) Avail: NTIS HC A03/MF A01

This Quality Assurace Program Plan defines the quality assurance program in effect for those activities of the Nevada Nuclear Waste Storage that are directly controlled by: DOE/NV, the Technical Overview Contractor, and the Quality Assurance Overview Contractor. It is intended as a supplement to the NNWSI-OAP (NVO-196-17). DOE

N83-16197# Los Alamos Scientific Lab., N. Mex.
EQUIPARTITIONING IN LINEAR ACCELERATORS
R. A. Jameson 1981 6 p refs Presented at 1981 Linear Accelerator Conf., Santa Fe, N. Mex., 19 Oct. 1981
(Contract W-7405-eng-36)
(DE82-002246; LA-UR-81-3073; CONF-811083-6) Avail: NTIS HC A02/MF A01

Emittance growth and linear accelerators, energy balance, or equipartitioning, between the degrees of freedom, to ameliorate the growth is examined in relation to linear. It is observed that the average transverse and longitudinal velocity spreads tend to equalize as current in the channel is increased, while the sum of the energy in the system stays nearly constant. The simple set of equations leading to this condition are outlined. Using powerful analytical and computational methods, collective instabilities in transported beams are investigated and thresholds and regions in parameter space where instabilities occur are identified. This is an important generalization. The results are essentially the same in r-z coordinates for transport systems, and evidence is presented that shows transport system boundaries to be quite accurate in computer simulations of accelerating systems also. Discussed are preliminary results of efforts to design accelerators that avoid parameter regions where emittance is affected by the instabilities identified by Hofmann. These efforts suggest that other mechanisms are present. The complicated behavior of the RFQ linanc in this framework also is shown. DOE

N83-16198# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

EXPERIMENTAL COMPARISON OF ALTERNATIVE SOLID FORMS FOR SAVANNAH RIVER HIGH-LEVEL WASTES
J. A. Stone 1981 35 p Presented at the Ann. Meeting of the Mater. Res. Soc., Boston, 16 Nov. 1981
(Contract DE-AC09-76SR-00001)
(DE82-004298; DP-MS-81-102; CONF-811122-21) Avail: NTIS HC A03/MF A01

Some of the conclusions of this study: no waste form has a clear advantage; ceramic forms retain uranium best; high silica glass retains cesium best; all forms retain rare earths (cerium) well; all forms leach incongruently; leaching increases with temperature; effect of leachant is small; and effect of sludge type is small, with exceptions. DOE

N83-16124# Institute of Nuclear Research, Swierk (Poland).
FUSION AT COUNTERSTREAMING ION BEAMS: IONS OPTIC FUSION (IOF)
M. Gryzinski *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 94-100 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

74 OPTICS

Includes light phenomena.

N83-16199*# Arkansas Univ., Little Rock. Dept. of Electronics and Instrumentation.
A MICROPROCESSOR-BASED ONE DIMENSIONAL OPTICAL DATA PROCESSOR FOR SPATIAL FREQUENCY ANALYSIS Final Technical Report, Nov. 1979 - Aug. 1982
R. L. Collier and George S. Ballard 9 Dec. 1982 70 p refs
(Grant NGL-04-001-007)
(NASA-CR-169717; NAS 1.26:169717) Avail: NTIS HC A04/MF A01 CSCL 20F

A high degree of accuracy was obtained in measuring the spatial frequency spectrum of known samples using an optical data processor based on a microprocessor, which reliably collected intensity versus angle data. Stray light control, system alignment, and angle measurement problems were addressed and solved. The capabilities of the instrument were extended by the addition of appropriate optics to allow the use of different wavelengths of laser radiation and by increasing the travel limits of the rotating arm to + or - 160 degrees. The acquisition, storage, and plotting of data by the computer permits the researcher a free hand in data manipulation such as subtracting background scattering from a diffraction pattern. Tests conducted to verify the operation of the processor using a 25 mm diameter pinhole, a 39.37 line pairs per mm series of multiple slits, and a microscope slide coated with 1.091 mm diameter polystyrene latex spheres are described. A.R.H.

N83-16200# Science Applications, Inc., McLean, Va.
IMAGE UNDERSTANDING Semiannual Technical Report, May 1981 - Sep. 1982
Lee S. Baumann Sep. 1982 364 p refs Workshop held at Palo Alto, Calif., 15-16 Sep. 1982
(Contract MDA903-82-C-0160; ARPA Order 3456)
(AD-A120072; SAI-83-892-WA) Avail: NTIS HC A16/MF A01 CSCL 20/6

This document contains the technical papers and outlines of semi-annual progress reports presented by the research activities in Image Understanding, sponsored by the Information Processing Techniques Office; Defense Advanced Research Projects Agency. The papers were presented at a workshop conducted on 15-16 September 1982 in Palo Alto, California. Author (GRA)

N83-16201# Pennsylvania State Univ., University Park. Materials Research lab.
TERNARY SULFIDE INFRARED WINDOW MATERIALS Annual Report, 1 May 1980 - 31 Oct. 1981
William B. White 10 Oct. 1981 86 p refs
(Contract N00014-80-C-0526)
(AD-A120153; AR-1) Avail: NTIS HC A05/MF A01 CSCL 20/6

Ternary sulfides, in the most general sense, are all compounds which contain two cations and in which the sulfide ion, S(-2) is the anion. Taking all of the cations on the periodic table pair-wise leads to an immense number of possible commands. It is useful for an initial screening to categorize the cations by their atomic structure. The greatest and most interesting structural diversity was found in the families of ternry sulfide structures with the stoichiometric formula AB2S4. A very large number of compounds have been identified and there are X-ray diffraction data, but little else available for many of them. Most of these compounds are yellow or red implying optical band gaps in the 2.0 to 2.5 eV range and thus are candidate window materials, at least from the viewpoint of electronic absorption. Most of the work has been concentrated on compounds belonging to the two cubic structural families, Th3P4 and spinel. Of these only one compound, CaLa2S4 has really been carried the entire way from powder preparation to a massive slab suitable for optical measurements. GRA

N83-16202# Oklahoma State Univ., Stillwater. Dept. of Physics.
A STUDY OF THE DEFECTS PRODUCED BY THE GROWTH, POST TREATMENT, AND FABRICATION OF QUARTZ DEVICES Interim Report, Apr. 1981 - Mar. 1982
Larry E. Halliburton, Joel J. Martin, and William A. Sibley Griffiss AFB, N.Y. RADC Aug. 1982 94 p refs
(Contract F19628-80-C-0086; AF Proj. 2306)
(AD-A120649; RADC-TR-82-213) Avail: NTIS HC A05/MF A01 CSCL 20/6

At Oklahoma State University we are using acoustic loss, IR. ESR, and current-versus-time measurements to characterize the electrodiffusion process in quartz. Commercial sweeping is done in air and replaces the alkali ions with protons. We are carrying out this study using. H2, D2, and vacuum atmospheres. The current-versus-time curves for H2 and D2 electro-diffusion show a rapid initial drop and then level off to a small steady current. We believe that the initial drop is caused by the rapid removal of the alkali ions. For alkali sweeps, steady currents are observed and only small electric fields are required. Acoustic loss measurements verify that Na(+) and Li(+) can be readily interchanged. The results for K(+) are, at this time, uncertain. An initial vacuum electrolysis run showed that the current stopped after a short time, and subsequent IR and ESR tests showed that only a small amount of hydrogen was swept into the sample. We believe that the electrodiffusion can continue only as long as replacement ions (in this case protons) are brought into the sample. A study of the acoustic loss spectrum of a series of 5 MHz 5th overtone AT-cut resonator blanks all fabricated from the same bar of Premium Q grade quartz as a function of electrolysis and irradiation is nearly complete. GRA

N83-16203# Naval Research Lab., Washington, D. C. Research Computation Div.
COMPUTING THE GRAZING ANGLE OF SPECULAR REFLECTION Final Report
A. Miller and E. Vegh 21 Sep. 1982 11 p refs
(WF1214000)
(AD-A119959; NRL-8627) Avail: NTIS HC A02/MF A01 CSCL 20/6

Three methods are given for computing the grazing angle of specular reflection. The first gives an approximation to the grazing angle. The second is an iterative method, whose derivation is easy and provides for the computation of the grazing angle to any degree of accuracy specified. The third method shows that there is a closed form explicit expression for the grazing angle. This in turn also allows for a computation to an arbitrary degree of accuracy. A FORTRAN program of the second method is included. GRA

N83-16204# ITT Electro-Optical Products Div., Roanoke, Va.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM

FOR RUGGEDIZED TACTICAL FIBER OPTIC CABLE Progress Report, 1 Jul. - 30 Sep. 1981
D. Taylor Oct. 1981 125 p
(Contract DAAK80-79-C-0789)
(AD-A120780; PR-7; ITT-81-41-05A; CORADCOM-79-0789-7A) Avail: NTIS HC A06/MF A01 CSCL 13/8

This report covers the period from July 1981 through September 1981 of the manufacturing methods and technology program for ruggedized tactical fiber optic cable. The scope of this effort, as reported herein, includes the following tasks and achievements: Obtained CECOM approval for Estane (R)58309 polyurethane jacketing compound; Selected optical fibers for 12 confirmatory samples; Fabricated 12 confirmatory sample cables; and Evaluated optically, mechanically, and environmentally the confirmatory samples according to the test plan. GRA

N83-16205# ITT Electro-Optical Products Div., Roanoke, Va.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM FOR RUGGEDIZED TACTICAL FIBER OPTIC CABLE Progress Report, 1 Apr. - 30 Jun. 1981
J. Smith Sep. 1981 59 p
(Contract DAAK80-79-C-0789)
(AD-A120779; PR-6; ITT-81-38-03A; CORADCOM-79-0789-6A) Avail: NTIS HC A04/MF A01 CSCL 13/8

This report covers the period from April 1981 through June 1981 of the manufacturing methods and technology program for ruggedized tactical fiber optic cable. The scope of this effort, as reported herein, includes the following tasks and achievements in materials selection: Selection of polyurethane compound; Evaluation of selected compound; Fabrication of long cables for mechanical evaluation at room temperature, at -55 C and at +71C, and optical evaluation at room temperature and at -55 C, and Recommendation of a polyurethane compound for the cable MM&T program. GRA

N83-16206# Arizona Univ., Tucson.
IMAGE RECONSTRUCTION USING LARGE OPTICAL TELESCOPES Final Report, 1 Mar. 1978 - 30 Nov. 1981
E. K. Hege, P. A. Strittmatter, and N. J. Woolf Hanscom AFB, Mass. AFGL 15 Feb. 1982 123 p refs
(Contract F19628-78-C-0058; AF Proj. 2311)
(AD-A120410; AFGL-TR-82-0136) Avail: NTIS HC A06/MF A01 CSCL 20/6

This report concerns a digital television detector system with the capability to identify individual photon events. Using this system we have applied speckle techniques to objects fainter than +17 magnitude. We have developed data reduction and calibration methods that provide size and shape information accurate to better than 5% at the telescope diffraction limit, and have produced diffraction limited images for several targets. By extending speckle techniques to accurate measurement of low surface brightness objects we have measured diameters for over a dozen asteroids and possible detected binary systems, directly resolved and imaged the Pluto/Charon system, resolved a multiple QSO (quasar) and we have mapped and imaged asymmetries in the envelope around the supergiant star Alpha Orionis. A principle objective of this program was to show the utility of speckle interferometry for studying Earth-orbital satellites. This task required developing pointing and tracking algorithms for satellite acquisition and tracking using conventional astronomical telescopes. We successfully accomplished this objective and produced the first optical resolution of a high orbit satellite, a Soviet Molniya. GRA

N83-16207# Wisconsin Univ., Madison.
TRANSFER OF INFRARED AND VISIBLE RADIATION THROUGH CLOUDS OF FINITE HORIZONTAL AND VERTICAL EXTENT Final Report, 1 Jun. 1978 - 30 Jun. 1982
James A. Weinman Oct. 1982 5 p refs
(Grant DAAG29-78-G-0109)
(AD-A120432; ARO-15227.7-GS) Avail: NTIS HC A02/MF A01 CSCL 20/6

Grant DAAG29-78-G-0109 provided resources to investigate radiative transfer through non-stratified clouds. This study was addressed to the computation of solar and infrared flux and intensifies through horizontally finite clouds. The theory of these transfer processes was implemented by Monte Carlo techniques as well as by anaiytical models that could be rapidly implemented. Models developed under this grant will be applicable to models of climate and general circulation. The results of this study will also be applicable to remote sensing measurements obtained near turbulently dispersed smoke clouds. Author (GRA)

N83-16208# Los Alamos Scientific Lab., N. Mex.
BEAM-PROFILE MEASUREMENT ON THE MAGNETOELASTIC MICROSCOPE
Wayne L. Bongianni 1981 5 p ref Presented at the 28th Natl. Vacuum Symp., Anaheim, Calif., 3-6 Nov. 1981
(Contract W-7405-eng-36)
(DE82-000575; LA-UR-81-2721; CONF-811113-17) Avail: NTIS HC A02/MF A01

A proof-of-principle magnetoelastic lens has been shown to behave much as expected. Calibration of its behavior has been achieved in a relatively simple and repeatable way. The relatively good agreement with the magnetoelastic optics model gives rise to the hope that focusing of the internal field will ultimately give rise to diffraction limited operation; that is, to about 4 micron for shear wave operation at 1.0 GHz. (MOW) DOE

N83-16209# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
NONLINEAR OPTICAL TECHNIQUES FOR SURFACE STUDIES
Y. R. Shen Sep. 1981 17 p refs Presented at the 29th Midwest Solid State Conf., Chicago, 24-26 Sep. 1981
(Contract W-7405-eng-48)
(DE82-001969; LBL-13365; CONF-810987-1) Avail: NTIS HC A02/MF A01

Nonlinear optical techniques for monolayer detection of adsorbed molecules on surfaces are reviewed. It is shown that surface coherent anti-Stokes Raman scattering with picosecond pulses has the sensitivity of detecting submonolayer of molecules. On the other hand, second harmonic or sum frequency generation is also sensitive enough to detect molecular monolayers. Surface enhanced nonlinear optical effects on some rough metal surfaces were observed. This facilitates the detection of molecular monolayers on such surfaces, and makes the study of molecular adsorption at a liquid metal interface feasible. Advantages and disadvantages of the nonlinear optical techniques for surface studies are discussed. DOE

N83-15861*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PROPOSED OPTICAL PUMPING SYSTEM REQUIRING NO ELECTRIC POWER Final Report
Bert R. Phillips *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 11 p (For primary document see N83-15860 06-44)
Avail: NTIS HC A99/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N83-16210# Institute of Plasma Physics, Prague (Czechoslovakia).
THE INTERACTION OF AN ELECTROMAGNETIC WAVE WITH AN INHOMOGENEOUS PLASMA SLAB
J. Lacina and J. Preinhaelter Jul. 1982 23 p refs
(IPPCZ-242) Avail: Issuing Activity

In the connection with the problem of the plasma heating by high frequency waves, a numerical code to study the incidence of an electromagnetic wave on an inhomogeneous plasma slab was developed. In the one dimensional model the nonmagnetized plasma is described by means of the two fluid equations with a finite electron pressure and with the adiabatic condition for all

processes. It is shown that at the normal incidence of a wave on a cold plasma, the wave is reflected from the region of the plasma resonance. A standing wave arises which generates an electrostatic standing wave with twofold frequency. At the same time a density gradient is sharply steepening in this region. In a warm plasma the incident wave again creates a standing wave, but the nonlinear perturbations propagate from the region of plasma resonance with the ion sound velocity to the whole volume of plasma. In this case the density gradient does not change very much. In the region of plasma resonance the ion sound waves are also generated. Author

N83-16211# Electrotechnical Lab., Ibaraki (Japan).
MASS BALANCE ON THE ARC MODE SEED ELECTRODES
Sadayoshi Korenaga, Hiroyuki Imai, and Toshihisa Masuda Sep. 1982 36 p refs Backup document for AIAA Synoptic scheduled for publication in the Journal of Energy, Jul.-Aug. or Sep.-Oct., 1983
Avail: NTIS HC A03/MF A01

The mass transfer of seed material caused by arcing of condensed seed materials in MHD channels was investigated. Experiments were conducted in an electric furnace at atmospheric pressure and 1,250 C; K_2SO_4 was used as the seed material. Mass balance models are proposed, and the equations which indicate the relationship between the evaporation rates and arc current are derived. These equations are compared with experimental results. At the cathode, the calculated values agree well with the measured values. At the anode, good agreement is not obtained, because only a part of potassium metal generated on the surface of electrode evaporates into the atmosphere. M.G.

N83-16212# Geo-Centers, Inc., Newton, Mass.
EVALUATION OF PLASMA JET IGNITION FOR IMPROVED PERFORMANCE OF ALTERNATE FUELS Final Report, Feb. - Aug. 1982
J. F. Grant, Z. Golenko, and M. E. McIlwain Aug. 1982 87 p refs
(Contract DAAK70-82-C-0047; DA Proj. 1L1-62733-AH-20)
(AD-A120160; GC-TR-82-256) Avail: NTIS HC A05/MF A01 CSCL 21/2

Alcohols, such as ethanol and methanol, are potential substitutes for gasolines during periods of fuel shortages. The pure alcohols have been reported to cause performance and starting problems when used to fuel internal combustion engines. This study characterized how three modes of ignition, OEM magneto, high energy conventional spark (CI) and plasma jet ignition (PJI) influenced the engine combustion properties of ethanol, methanol and gasoline alcohol blends. Specific combustion properties examined in these measurement were burning velocity and lean limit. In addition, the engine performance was determined for 30% alcohol gasoline containing blends. These engine performance measurements determined brake power, brake specific fuel consumption and brake emissions of carbon monoxide and hydrocarbons. The findings of this study suggest that high energy ignition systems, such as plasma jet ignition, will improve both fuel combustion properties and engine performance. GRA

N83-16213# Boston Coll., Chestnut Hill, Mass.
STRONG COUPLING EFFECTS ON BOUND STATES IN PLASMAS Interim Progress Report, 1 Feb. 1981 - 31 Jul. 1982
Gabor J. Kalman Aug. 1982 10 p refs
(Grant AF-AFOSR-0091-81; AF Proj. 2301)
(AD-A120132; AFOSR-82-0805TR; IPR-1) Avail: NTIS HC A02/MF A01 CSCL 20/9

Progress in three major areas is reported: (1) kinetics and response of strongly coupled multicomponent plasmas; (2) study of plasma phase transition and determination of the degree of ionization of a dense plasma; (3) generalization of the Thomas-Fermi-Debye-Huckel scheme for strongly coupled plasmas with atoms and ions. GRA

N83-16214# JAYCOR, Alexandria, Va.
PERFORM EXPERIMENTS ON LINUS-O AND LTX IMPLODING LIQUID LINER FUSION SYSTEMS Final Report, 8 Sep. 1980 - 30 Sep. 1981
E. P. Scannell 27 Aug. 1982 26 p refs
(Contract N000173-80-C-0463)
(AD-A120052; J206-82-012/6203) Avail: NTIS HC A03/MF A01 CSCL 20/9

The Plasma Physics Division of the Naval Research Laboratory (NRL) has been conducting investigations of imploding liquid liner fusion systems for several years (Reference 1). This effort attained a significant milestone in 1978 with the construction of two machines: HELIUS and LINUS-O is a 60 MJ rotor system where a cylindrical liquid sodium - potassium (NaK) metal liner is radially compressed from a 30 cm to 1 cm diameter by gas pressure from multiple high explosive charges. These charges act on an annular piston in contact with the liquid NaK liner material. HELIUS is a half-scale vertical axis version of LINUS-O using high pressure helium to drive the annular piston. HELIUS is designed to be a test bed for new concepts and to permit testing of new modifications to LINUS-O. The principal virtue of HELIUS is its capability for ten to twenty shots per day as compared to two or three shots per day for LINUS-O. In addition, HELIUS is designed to provide higher drive pressures than were previously obtainable with water models for liner gydrodynamic studies and a magnetic flux compression capability up to approx. 100 kG. GRA

N83-16215# Northwestern Univ., Evanston, Ill. Dept. of Mechanical and Nuclear Engineering.
COMPUTER SIMULATION OF KINETIC PROPERTIES OF PLASMAS Final Report
Jacques Denavit Aug. 1982 18 p refs
(Contract N00014-75-C-0473)
(AD-A120096; FR-9) Avail: NTIS HC A02/MF A01 CSCL 20/9

The research was directed toward the development and testing of new numerical methods for particle and hybrid simulation of plasmas, and their application to physical problems of current significance in space physics and in energetic charged-particles systems. This project will terminate on August 31, 1982 and this Final Report describes (1) the research accomplished since the last renewal on April 1, 1981, and (2) a perspective of the work done since the beginning of the project in February 1972. GRA

N83-16216# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
PLASMA WAVES STIMULATED BY ELECTRON BEAMS IN THE LAB AND IN THE AURORAL IONOSPHERE
Robert H. Holzworth, Wallace B. Harbridge, and Harry C. Koons 1 Oct. 1982 21 p refs
(Contracts F04701-82-C-0083; NOAA-03-5-022-95)
(AD-A120094; TR-0083(3940-06)-1; SD-TR-82-69) Avail: NTIS HC A02/MF A01 CSCL 20/9

Energetic electron beams are frequently used as active probes of space plasmas. Often the assumed test particle nature of these electrons is violated when the electron beam stimulates plasma wave emissions. Such complex phenomena have been observed on rockets and satellites and are being modeled in laboratory plasmas. The large vacuum chamber at NASA Johnson Space Center in Houston, Texas has been used for modeling F-region type ionospheric plasmas. A VLF receiver has been flown into an auroral plasma and the spectra from this flight will be compared to VLF spectra obtained in the NASA/JSC laboratory chamber. The electron beam is believed to have produced beam plasma discharge (BPD) on the rocket similar to that seen in the lab. At times during the rocket flight the electron beam was operated at 4 kilovolts and the electron current modulated at 3 kilohertz from 0 to 80 milliamps. This resulted in the beam pulsing in and out of BPD and a variety of propagating wave modes. The laboratory VLF electric field spectra during BPD show a characteristic peak at a few kilohertz with amplitudes over 100 mV/m. This peak broadens and moves to higher frequencies as the current is increased at a fixed electron voltage. Other features of BPD in the lab as seen in the VLF spectra include appearance of the

spectral peak prior to optical BPD threshold, differences between E and B spectra below the peak, and oscillation in and out of BPD, even under a steady-state electron gun current on time scales of 100 ms. GRA

N83-16217# Princeton Univ., N. J. Plasma Physics Lab.
HIGH-N COLLISIONLESS BALLOONING MODES IN AXISYMMETRIC TOROIDAL PLASMAS
C. Z. Cheng 1981 39 p refs
(Contract DE-AC02-76CH-03073)
(DE82-002831; PPPL-1841) Avail: NTIS HC A03/MF A01

A collisionless kinetic ballooning mode equation, which includes the full ion finite Larmor radius (FLR), the magnetic drift, and the trapped electron effects is derived and investigated for a large aspect ratio circular flux surface equilibrium in the frequency regime, 0 mega/sub bi/, 0 mega/sub ti/ less than 0 mega less than 0 mega/sub be/, 0 mega/sub te/. The finite Larmor radius effects can reduce the growth rate, but do not stabilize the ballooning modes due to the destabilizing influence of the ion magnetic drift resonance. It is, in general, incorrect to simulate the FLR effects by employing the often used FLR modified model. The trapped electrons have a stabilizing effect due to the reduction of the destabilizing circulating electron parallel current perturbation. For typical Tokamak aspect ratio, the critical beta can be improved by 40%. DOE

N83-16218# Los Alamos Scientific Lab., N. Mex.
ELMO BUMPY TORUS FUSION-REACTOR DESIGN STUDY
R. A. Krakowski and D. DeFreece 1981 6 p refs Presented at the 9th Symp. on Eng. Probl. of Fusion Res., Chicago, Ill., 26 Oct. 1981
(Contract W-7405-eng-36)
(DE82-002388; LA-UR-81-3144; CONF-811040-50) Avail: NTIS HC A02/MF A01

A complete power plant design of a 1200-MWe ELMO Bumpy Torus Reactor (EBTR) is described. Those features that are unique to the EBT confinement concept are emphasized, with subsystems and balance-of-plant items that are generic to magnetic fusion being adopted from past, more extensive Tokamak reactor designs. This overview paper stresses the design philosophy and assumptions that led to an economic, 35-m major-radius design that at 1.4 MW/sq meter wall loading generates 4000 MWt with a 15% recirculating power fraction. DOE

N83-16219# Princeton Univ., N. J. Plasma Physics Lab.
ION-ACOUSTIC DOUBLE LAYERS IN THE PRESENCE OF PLASMA SOURCE
H. Okuda and M. Ashout-Abdalla Nov. 1981 28 p refs Original document was announced as A82-44760
(Contract DE-AC02-76CH-03073)
(DE82-002828; PPPL-1845) Avail: NTIS HC A03/MF A01

Steady state plasma turbulence and formation of negative potential spikes and double layers in the presence of ion acoustic instabilities were studied by means of one dimensional particle simulations in which velocities of a small fraction of electrons are replaced by the initial drifting Maxwellian at a constant rate. A steady state is found where negative potential spikes appear randomly in space and time giving rise to an anomalous resistivity much greater than previously found. Comparisons of the simulation results with laboratory and space plasmas are discussed. DOE

N83-16220# Los Alamos Scientific Lab., N. Mex.
HELIOS MOVABLE HARTMANN BALL
H. E. Tucker, R. D. Day, R. O. Hedges, J. A. Hanlon, and B. L. Kortegaard 1981 4 p Presented at the 7th Conf. on Appl. Mech., Kansas City, Mo., 7 Dec. 1981
(Contract W-7405-eng-36)
(DE82-000756; LA-UR-81-2874; CONF-811209-1) Avail: NTIS HC A02/MF A01

The Helios movable Hartmann ball is described in its function to precisely align the laser and target area. It provides the laser fusion facility with additional target illumination flexibility so that many additional parameters can be investigated in the realm of target implosion physics. DOE

N83-16221# Princeton Univ., N. J. Plasma Physics Lab.
NONLINEAR GYROKINETIC EQUATIONS FOR LOW-FREQUENCY ELECTROMAGNETIC WAVES IN GENERAL PLASMA EQUILIBRIA
E. A. Frieman and L. Chen Oct. 1981 29 p refs
(Contract DE-AC02-76CH-03073)
(DE82-002290; PPPL-1834) Avail: NTIS HC A03/MF A01

A nonlinear gyrokinetic formalism for low frequency (less than the cyclotron frequency) microscopic electromagnetic perturbations in general magnetic field configurations is developed. The nonlinear equations thus derived are valid in the strong turbulence regions and contain effects due to finite Larmor radius, plasma inhomogeneities, and magnetic field geometries. The specific case of axisymmetric Tokamaks is then considered, and a model nonlinear equation is derived for electrostatic drift waves. Also, applying the formalism to the shear Alfven wave heating scene, it is found that nonlinear ion Landau damping of kinetic shear Alfven waves is modified, both qualitatively and quantitatively, by the diamagnetic drift effects. In particular, wave energy is found to cascade in wavenumber instead of frequency. DOE

N83-16222# Princeton Univ., N. J. Plasma Physics Lab.
EFFECT OF LOW-FREQUENCY DENSITY FLUCTUATIONS ON ION-CYCLOTRON WAVES
Masayuki Ono Oct. 1981 34 p refs
(Contract DE-AC02-76CH-03073)
(DE82-002829; PPPL-1836) Avail: NTIS HC A03/MF A01

Scattering of waves in the ion cyclotron range of frequencies by low-frequency fluctuations is analyzed in the weak turbulence approximation. Finite-ion-Larmor radius, multi-ion-species, ion-drift-motion, and electromagnetic terms are included in the wave kinetic equation. Conditions for significant scattering have been identified for the fast wave as well as for externally launched ion Bernstein waves. Implications for ICRF heating in Tokamak plasmas are discussed. DOE

N83-16223# Princeton Univ., N. J. Plasma Physics Lab.
GYROKINETIC APPROACH IN PARTICLE SIMULATION
W. W. Lee Oct. 1981 28 p refs
(Contract DE-AC02-76CH-03073)
(DE82-002830; PPPL-1838) Avail: NTIS HC A03/MF A01

A new scheme for particle simulation based on the gyrophase-averaged Vlasov equation was developed. It is suitable for studying low-frequency microinstabilities and the associated anomalous transport in magnetically confined plasmas. The scheme retains the gyroradius effects but not the gyromotion; it is, therefore, far more efficient and versatile than the conventional ones. Furthermore, the reduced Vlasov equation is also amenable to analytical studies. DOE

N83-16224# Princeton Univ., N. J. Plasma Physics Lab.
PLASMA HEATING WITH MULTI-MeV NEUTRAL ATOM BEAMS
L. R. Grisham, D. E. Post, D. R. Mikkelsen, and H. P. Eubanks Oct. 1981 51 p refs
(Contract DE-AC02-76CH-03073)
(DE82-002827; PPPL-1839) Avail: NTIS HC A04/MF A01

The utility and feasibility of neutral beams of equal to or greater than 6 AMU formed from negative ions, and also of D(0) formed from D(-) are discussed. The negative ions would be accelerated to approximately 1 to 2 MeV/AMU and neutralized, whereupon the neutral atoms would be used to heat and, perhaps, to drive current in magnetically confined plasmas. Such beams appear feasible and offer the promise of significant advantages reltive to conventional neutral beams based on positive deuterium ions at approximation 150 keV. DOE

N83-16225# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics.
LOW FREQUENCE MODES ASSOCIATED WITH DRIFT MO-

TIONS IN INHOMOGENEOUS PLASMAS
Jan Weiland 1981 50 p refs
(DE81-700007; CTH-IEFT/PP-1981-1) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

The basic theory, linear and nonlinear, of low frequency vortex modes in inhomogeneous plasmas is reviewed. Special emphasis is put on the basic physics of processes important for the confinement and stability of magnetically confined plasmas such as effects of curvature drift and trapped particles. DOE

N83-16226# Association Euratom-CEA, Fontenay-aux-Roses (France).
STUDY OF THE IONIC DISTRIBUTION AND OF THE ENERGY DEPOSITION IN A PLASMA OF TOKAMAK HEATED BY INJECTION OF FAST NEUTRALS Ph.D. Thesis - Paris-Sud Univ.
Brigitte Gagey Mar. 1981 162 p refs In FRENCH; ENGLISH summary
(EUR-CEA-FC-1094) Avail: NTIS (US Sales Only) HC A08/MF A01; DOE Depository Libraries

In the Tokamak TFR 600 fast neutrals injection is done almost perpendicular to the magnetic field so it is expected theoretically that perpendicular injection would be more susceptible to drive microinstabilities. Assuming the energy slowing-down is classical, a Monte-Carlo code was modified to calculate self-consistently the behavior of the fast ions in the real plasma and the real magnetic configuration. The code allows to obtain the energy deposition profiles and the fast ions distribution function at a given moment of the injection. Absolutely calibrated electrostatic analyzers measured the fast ions which are lost by charge exchange versus toroidal and poloidal angles in different experimental conditions. The measurements are in good agreement with the code. Plasma evolution during injection was studied by assuming the calculated energy deposition profiles. The Monte-Carlo code was coupled with a one dimensional plasma simulation code which treats the evolution of the densities, temperatures and ohmic current, without any additional heating. DOE

N83-16227# Los Alamos Scientific Lab., N. Mex.
ION KINETIC EFFECTS ON THE TILT MODE IN FRCS
J. L. Schwarzmeier, C. E. Seyler (Cornell Univ., Ithaca, N.Y.), and D. C. Barnes (Texas Univ., Austin) 1981 5 p refs Presented at the 4th Symp. on the Phys. and Technol. of Compact Toroids, Livermore, Calif., 27-30 Oct. 1981
(Contract W-7405-eng-36)
(DE82-002329; LA-UR-81-3159; CONF-811087-5) Avail: NTIS HC A02/MF A01

Theory and simulations show that field reversed configurations (FRG's) should be unstable magnetohydrodynamically to the tilting mode, yet tilting seldom is seen in the experiments. Profile effects (within MHD) and ion finite larmor radius effects are proposed to explain the observed stability of FRC's. DOE

N83-16228# California Univ., Livermore. Lawrence Livermore Lab.
THE MFTF-B PLASMA DIAGNOSTIC SYSTEM
A. L. Throop, D. A. Goerz, and S. R. Thomas 21 Oct. 1981 7 p refs Presented at 9th Symp. on Engr. Probl. of Fusion Res., Chicago, 26 Oct. 1981 Submitted for publication
(Contract W-7405-eng-48)
(DE82-002594; UCRL-86124; CONF-811040-58) Avail: NTIS HC A02/MF A01

The plasma diagnostic system for MFTF-B is described. The system requirement changes which have occurred as a result of the funded rescoping of the original MFTF facility into MFTF-B are discussed. The diagnostic instruments which are planned are outlined and an overview of the diagnostic system is presented. DOE

N83-16229# Texas Univ., Austin. Inst. for Fusion Studies.
STABILIZATION OF AXISYMMETRIC MIRROR PLASMA BY ENERGETIC ION INJECTIONS
F. L. Hinton and M. N. Rosenbluth Oct. 1981 37 p refs
(Contract DE-FG05-80ET-53088)
(DE81-030341; DOE/ET-53088/42) Avail: NTIS HC A03/MF A01

Plasmas in axisymmetric mirror devices can be made stable to MHD interchange modes by injecting energetic ions which contribute significantly to the pressure and spend a sufficiently large fraction of a bounce time in regions of favorable curvature. Pitch angle scattering adversely affects the method by reducing this fraction. The ions must be sufficiently energetic that pitch-angle scattering is not detrimental for that part of a slowing-down time during which they contribute significantly to the pressure. We have solved the bounce-averaged Fokker-Planck equation, including drag and pitch-angle scattering, and calculated the energetic ion contribution to the stability integral. With specially tailored magnetic fields, the required injection energy and power draining are found to be reasonable. DOE

N83-16230# Oak Ridge National Lab., Tenn.
AUTHORS GUIDE TO PUBLISHING IN THE FIELDS OF PLASMA PHYSICS AND CONTROLLED FUSION
Oct. 1981 29 p Presented at the 23rd Ann. Meeting of the Div. of Plasma Phys. of the APS, New York, 12 Oct. 1981
(Contract W-7405-eng-26)
(DE82-002866; CONF-811028-7) Avail: NTIS HC A03/MF A01

The purview, audience, and special restrictions are listed for 27 journals in the international literature that publish articles on plasma physics and controlled fusion. A.R.H.

N83-16231# General Atomic Co., San Diego, Calif.
PROSPECTS OF LOW-ACTIVATION FUSION-REACTOR DESIGN
G. R. Hopkins, E. T. Cheng, I. Maya, C. P. C. Wong, and K. R. Schultz Oct. 1981 7 p refs Presented at 9th Symp. on Engr. Probl. of Fusion Res., Chicago, 26-29 Oct. 1981 Submitted for publication
(Contract DE-AT03-76ET-51011)
(DE82-003198; GA-A-16552; CONF-811040-88) Avail: NTIS HC A02/MF A01

A design study was performed to investigate the implications of using low activation materials in a fusion power reactor. Using the STARFIRE reactor as a model, low activation design concepts were studied for the four major regions of a fusion reactor: first wall and limiter, blanket, shield, and magnet windings. The first wall and limiter are made of water-cooled aluminum. The blanket uses an unpressurized silicon carbide structure containing Li2O breeding material with high temperature, high pressure helium coolant contained in SiC thimble tubes. The shield is made of SiC and B4C with an aluminum structure. The superconducting magnets use an aluminum stabilizer and aluminum or carbon fiber epoxy composite for the structure and dewar. DOE

N83-16232# Oak Ridge National Lab., Tenn.
ENGINEERING FEATURES OF THE INTOR CONCEPTUAL DESIGN
T. E. Shannon 1981 4 p refs Presented at the 9th Symp. on Eng. Probl. of Fusion Res., Chicago, 26 Oct. 1981
(Contract W-7405-eng-26)
(DE82-002808; CONF-811040-90) Avail: NTIS HC A02/MF A01

The INTOR engineering design has been strongly influenced by considerations for assembly and maintenance. A maintenance philosophy was established at the outset of the conceptual design to insure that the Tokamak configuration would be developed to accommodate maintenance requirements. The main features of the INTOR design are summarized in this paper with primary emphasis on the impact of maintenance considerations. DOE

N83-16233# Oak Ridge National Lab., Tenn.
CAMAC BASED INTER-COMPUTER COMMUNICATIONS SYSTEM
D. E. Greenwood and R. D. Burris 1981 3 p refs Presented at the 9th Symp. on Eng. Probl. of Fusion Res., Chicago, 26 Oct. 1981
(Contract W-7405-eng-26)
(DE82-002879; CONF-811040-93) Avail: NTIS HC A02/MF A01

To provide communications between dissimilar computers for the ELMO Bumpy Torus (EBT) experiment CAMAC hardware was used. The software supports file and individual message transfers. The system has proven to be both reliable and fast, with transmission rates of about 36,000 baud. DOE

N83-16115# Kurchatov (I. V.) Inst. of Atomic Energy, Moscow (USSR).
TOKAMAK RESEARCH IN THE SOVIET UNION
V. S. Strelkov *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 3-13 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16116# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
LOWER-HYBRID HEATING EXPERIMENT ON THE TM-1-MH TOKAMAK
J. Datlov, K. Jakubka, Vl. Kopecky, S. Koerbel, L. Kryska, P. Magula, J. Stoeckel, and F. Zacek *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 37-40 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16117# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
POWER SPECTRUM OPTIMIZATION OF THE THREE-WAVEGUIDE GRILL FOR THE T-7 TOKAMAK
J. Preinhaelter, Z. Sedlacek, and S. Koerbel *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 41-46 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16118# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
SHORT WAVELENGTH LOWER HYBRID WAVES NONLINEARLY EXCITED DUE TO PONDEROMOTIVE DENSITY MODULATION
R. Klima, I. M. Pankratov, P. Pavlo, and V. A. Petrzilka *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 47-51 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16119# State Coll. of Mining and Metallurgy, Ostaua-Poruba (Czechoslovakia). Dept. of Physics.
ELECTRON IMPACT IONIZATION OF HIGHLY CHARGED MOLYBDENUM IMPURITIES IN TOKAMAK PLASMAS
V. Strzondala *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 52-53 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16120# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
ANDROMEDA: THE SYSTEM FOR THE ACQUISITION AND NUMERICAL DATA PROCESSING AND ITS APPLICATION FOR EXPERIMENTAL DEVICE TOKAMAK TM-1-MH
L. Kryska and S. Koerbel *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 54-55 (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16121# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
SOFT X-RAY DIAGNOSTICS ON TOKAMAK TM-1-MH
P. Magula *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 56-59 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16122# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
ENERGY BALANCE IN TM-1-MH TOKAMAK (OHMICAL HEATING)
J. Stoeckel, S. Koerbel, L. Kryska, V. Kopecky, V. Dadalec, J. Datlov, K. Jakubka, P. Magula, F. Zacek, G. V. Pereverzev (Kurchatov Inst. of Atomic Energy) et al *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 60-64 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16123# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
COMPUTER SIMULATIONS OF REFLEX E-BEAM SYSTEMS AND PLASMA STABILITY
K. Jungwirth and P. Stavinoha *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 77-93 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16125# Technical Univ. of Zamek (Czechoslovakia). Electrotechnical Faculty.
DEVELOPMENT OF CURRENT SHEAT ON OUTPUT OF COAXIAL GUN
J. Kravarik, P. Kubes, and J. Hruska *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 101-102 (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16129# Academy of Sciences, Berlin (East Germany). Zentralinst. fuer Elektronenphysik.
CRATER FORMATION BY HIGH CURRENT DISCHARGES IN VACUUM
P. Siemroth and B. Juettner *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 109-111 refs (For primary document see N83-16114 06-70)
Avail: NTiS HC A08/MF A01

N83-16130# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
SOFT X-RAY AND VUV EMISSION FROM REB-HEATED PLASMA IN REBEX 1 AMD REBEX 1 MACHINES
V. Piffl and V. Raus *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 112-113 (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16131# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
DYNAMICAL MODEL OF AN OVERHEATED MAGNETIZED PLASMA
K. Jungwirth and J. Ullschmied *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 114-115 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16132# Academy of Sciences, Berlin (East Germany). Zentralinst. fuer Elektronenphysik.
DYNAMICS OF IONIZATION AND TRANSPORT IN A MAGNETICALLY CONFINED PLASMA COLUMN
H. Prinzler and P. Heymann *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 118-125 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16133# Institute of Physics and Technology of Radiation Devices, Bucharest (Rumania).
A TIME RESOLVING METHOD FOR DETERMINING THE ENERGY SPECTRUM OF NEUTRONS EMITTED BY A PLASMA FOCUS DEVICE
I. I. Popescu and M. Vlad *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 126-127 ref (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16134# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
APPARATUS FOR PLASMA ELECTRON TEMPERATURE AND DENSITY MEASUREMENTS BY THOMSON SCATTERING
K. Kolacek and V. Babicky *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 128-129 refs (For primary document see N83-16114 06-71)
Avail: NTIS HC A08/MF A01

N83-16135# College of Mechanical and Electrical Engineering, Plzen (Czechoslovakia). Dept. of Physics.
DIAGNOSTICS OF NONEQUILIBRIUM HYDROGEN PLASMA
J. Ferdinand *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 130-134 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16137# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
GLOBAL MODEL OF A HYBRID TOKAMAK REACTOR WITH AN AUXILIARY RF HEATING
L. Krlin, P. Pavlo, and Z. Tluchor *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 143-152 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16139# College of Mechanical and Electrical Engineering, Plzen (Czechoslovakia). Dept. of Physics.
HELIUM POPULATION MODEL
J. Slavik *In* Ceskoslovenska Akademie Ved. 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 157-159 (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

N83-16140# Ceskoslovenska Akademie Ved, Prague. Inst. of Plasma Physics.
NUMERICAL SIMULATION OF THE INTERACTION OF AN ELECTROMAGNETIC WAVE WITH AN INHOMOGENEOUS PLASMA
J. Lacina and J. Preinhaelter *In its* 11th Czechoslovak Seminar on Plasma Phys. and Technol. Oct. 1981 p 160-162 refs (For primary document see N83-16114 06-70)
Avail: NTIS HC A08/MF A01

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N83-16234*# Beers Associates, Inc., Reston, Va.
CONTINUED DEVELOPMENT OF A DETAILED MODEL OF ARC DISCHARGE DYNAMICS Contract Report, Aug. 1980 - Mar. 1982
B. L. Beers, V. W. Pine, and S. T. Ives 14 Dec. 1982 156 p refs
(Contract NAS3-22530)
(NASA-CR-167977; NAS 1.26:167977; BEERS-1-82-16-23) Avail: NTIS HC A08/MF A01 CSCL 20L

Using a previously developed set of codes (SEMC, CASCAD, ACORN), a parametric study was performed to quantify the parameters which describe the development of a single electron indicated avalanche into a negative tip streamer. The electron distribution function in Teflon is presented for values of the electric field in the range of four-hundred million volts/meter to four billon volts/meter. A formulation of the scattering parameters is developed which shows that the transport can be represented by three independent variables. The distribution of ionization sites is used to indicate an avalanche. The self consistent evolution of the avalanche is computed over the parameter range of scattering set. Author

N83-16235# Wisconsin Univ., Madison. Dept. of Chemistry.
MAPPING OF THE EFFICIENCY OF ELECTRON-HOLE PAIR SEPARATION FOR A SEMICONDUCTOR ELECTRODE: LUMINESCENT PROPERTIES OF GRADED CADMIUM SULFOSELENIDE ELECTRODES
Holger H. Streckert and Arthur E. Ellis 23 Sep. 1982 26 p refs (Contract N00014-78-C-0633)
(AD-A120171; UWIS/DC/TR-82/2) Avail: NTIS HC A03/MF A01 CSCL 20/12

Inhomogeneous samples of n-type CdS(X)Se(1-X) (0 < or = X < or = 1) have been prepared by vapor-phase diffusion of S into a single-crystal CdSe substrate. Characterization by Auger electron spectroscopy (AES) in conjunction with Ar ion sputter etching reveals that S was substituted for Se in the lattice to produce a graded region. The depth profile analysis indicates a composition of CdS over the first approx. 0.05 micron from the surface; over the next approx. 2 micron from the surface, the composition monotonically deceases in X, corresponding to a decline in band gap energy from approx. 2.4 eV for CdS to approx. 1.7 eV for CdSe. Photoluminesence (PL) and electroluminescence (EL) from the graded material appear to derive from the luminescence of the CdS(X)Se(1-X) compositions which comprise the graded region. Emission from approx. 470-750 nm matches the spectral region spanned by PL and EL from homogeneous, single crystal CdS(X)Se(1-X) samples which emit near their band gap energies. This assignment is also supported by chemical etching experiments in which the removal of S-rich, near-surface strata progressively red-shifts the PL spectra. GRA

N83-16236# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Electronic Research Branch.
POTENTIAL FOR HIGH TEMPERATURE SUPERCONDUCTIVITY Final Report, Apr. 1980 - Oct. 1981
Donald C. Reynolds, Y. Chung, and S. B. Nam Jul. 1982 39 p refs
(AF Proj. 2306)
(AD-A120156; AFWAL-TR-82-1031) Avail: NTIS HC A03/MF A01 CSCL 20/3

The investigation of Cu Cl at high pressure revealed magnetic anomalies that were characteristic of a superconducting state. Subsequent to these investigations similar effects were observed in pressure quenched CdS. These preliminary results were very promising, though considerably more work was required to confirm the mechanism as well as to gain a better understanding of the materials that exhibit the desired properties. In view of these observations an LDF program was initiated, the goal of which was to reproduce some of the magnetic anomalies and to try to understand something of the mechanism as well as what properties the materials needed to demonstrate the effect. The initial investigations were very devoted to Cu Cl since more was known about the high temperature diamagnetic anomaly in this material than any other material. Pressure cells were constructed and a variable temperature Dewar was obtained so the magnetic properties could be investigated over a temperature to liqid helium temperature. The necessary equipment was assembled to measure the diamagnetic and paramagnetic susceptibilities. Cu Cl crystals were grown from the melt from the vapor phase and by a flux technique. The first experiments that were done were optical experiments designed to characterize the starting material as well as to obtain information relating to the material properties that might relate to the mechanisms involved. From high resolution emission experiments a center was observed that could be then center from which the superconducting electrons are supplied as predicted by theory. Studies were made on pressure quenched CdS where both diamagnetic and paramagnetic anomalies were observed. GRA

N83-16237# Pennsylvania Univ., Philadelphia. Dept. of Materials Science and Engineering.
DIVALENT BETA ALUMINAS: HIGH CONDUCTIVITY SOLID ELECTROLYTES FOR DIVALENT CATIONS
G. C. Farrington and B. Dunn (California Univ., Los Angeles) 13 Oct. 1982 58 p refs Submitted for publication

(Contract N00014-81-K-0526; Grant NSF DMR-79-23647)
(AD-A120675; TR-1) Avail: NTIS HC A04/MF A01

The Na(+) content of beta alumina can be replaced by a variety of divalent cations in simple ion exchange reactions. The resulting divalent beta' aluminas are the first family of high conductivity solid electrolytes for divalent cations. Divalent beta' aluminas which have been prepared so far include conductors of Ca(2+), Sr(2+), Ba(2+), Zn(2+), Cd(2+), Pb(2+), Hg(2+), and Mn(2+). Most have conductivities of about 0.1/(ohm-cm) at 300-400 C. However, the conductivity of Pb(++) beta alumina is 0.0046/(ohm-cm) at 40 C, nearly equal to that of Na(+) beta alumina. Preliminary structure studies indicate that order-disorder reactions among the divalent cations and vacancies in the conduction region of beta alumina critically influence conductivity in the structure. GRA

N83-16238*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FABRICATION AND PROPERTIES OF MULTILAYER STRUCTURES Semiannual Technical Report, 1 Sep. 1981 - 28 Feb. 1982
William A. Tiller, T. W. Barbee, Jr., T. Halicioglu, L. Landsberger, C. Lee, G. McGlinn, A. Savan, and K. Seaward Aug. 1982 120 p refs Prepared in cooperation with Stanford Univ.
(Contract MDA903-81-C-0578; ARPA Order 3706)
(NASA-TM-85135; NAS 1.15:85135; AD-A120071; SU-DMS-82-R-4; SATR-4) Avail: NTIS HC A06/MF A01 CSCL 13/8

This program has as its goal the development of vapor deposition processes for application to integrated circuit technology. Its purpose is to investigate vapor deposition techniques that offer potential for synthesis of materials having new, unique structures and/or of higher quality than currently attainable. Technological application of these materials will be a significant consideration in the selection of specific systems for study. This report focuses on five individual work areas: (1) synthesis of SiO(X), (2) synthesis of SiC, (3) synthesis of Pd2Si, (4) electrical diagnostics of films, and (5) computer simulation of film synthesis. GRA

N83-16239# Westinghouse Electric Corp., Pittsburgh, Pa.
MSW VARIABLE TIME-DELAY TECHNIQUES Interim Report, 1 Aug. 1980 - 30 Sep. 1981
J. D. Adam, M. R. Daniel, P. R.. Emtage, and R. W. Weinert Griffiss AFB, N.Y. RADC Jul. 1982 76 p refs
(Contract F19628-80-C-0150; AF Proj. 2305)
(AD-A120648; Rept-81-6F3-DELAY-R4; RADC-TR-82-206) Avail: NTIS HC A05/MF A01 CSCL 20/2

Work performed during the first year of a program to investigate magnetostatic wave device techniques for phased arrays and microwave signal processing is described. Among the topics covered is a variable delay line formed by a backward volume wave down-chirp and a forward volume wave up-chirp; propagation in YIG films biased at an arbitrary angle; propagation and transduction in double YIG films; and the growth of Sm-doped GGG suitable for use as an epitaxial spacer between two YIG films. GRA

N83-16240# EIC, Inc., Newton, Mass.
PHOTOELECTROCHEMICAL DEPOSITION OF METALS ONTO P-SILICON USING AN INTERNAL CELL
Timothy L. Rose, David H. Longendorfer, and R. David Rauh Oct. 1982 20 p refs Submitted for publication
(Contract N00014-79-C-0700; NR Proj. 359-723)
(AD-A120643; C-598; TR-6) Avail: NTIS HC A02/MF A01 CSCL 20/12

Spatially defined photoelectrochemical deposition of low work function metals onto p-Si was observed, operating through a local cell. GRA

N83-16241# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
ELECTRONIC SIMULATION OF THE JOSEPHSON EFFECTS
Daniel Jablonski 1 Dec. 1981 312 p refs
(AD-A120753; AD-F500077; NSWC/MP-81-519) Avail: NTIS HC A14/MF A01 CSCL 20/10

An electronic simulator of the Josephson effects is described. The device is based on an analogue phase-locked loop design, and includes the effects of voltage, frequency, temperature, and the superconducting energy gap. Results obtained using the simulator are compared with theory and results obtained from actual Josephson tunnel junctions. GRA

N83-16242# Washington Univ., St. Louis, Mo. Semiconductor Research Lab.
GROUPS TWO-FOUR-FIVE2 CHALCOPYRITES FOR HIGH SPEED DEVICES Final Technical Report, 1 Jun. 1979 - 31 May 1982
C. M. Wolfe, M. W. Muller, G. A. Davis, and S. Julie Hsieh 31 Jul. 1982 140 p refs
(Grant AF-AFOSR-0096-79; AF Proj. 2306)
(AD-A120416; WU/SRL-59457-5; AFOSR-82-0906TR) Avail: NTIS HC A07/MF A01 CSCL 20/2

There is evidence that some of the II-IV-V2 chalcopyrites have basic electronic properties that are superior to the properties of their analog III-V sphalerite compounds for high speed devices. The primary objective of this work was to investigate techniques for the growth of high-quality epitaxial II-IV-V2 chalcopyrite layers on III-V substrates. For this purpose we initially selected CdSnP2 which nearly lattice matches InP and ZnGeAs2 which matches GaAs. Discussions in the literature have pointed out several problems with the usual theory of heterostructures. We present a general, first-order, nonequilibrium thermodynamic analysis which points out that one problem with conventional theory is that it neglects a generalized thermodynamic force. This force can be associated with the gradient of the effective density-of-states. In heterostructures such gradients cause the charge carriers to move into regions with higher density-of-states, thus increasing the entropy of the system in agreement with the second law of thermodynamics. We also show that if the electrochemical potential is referenced to the infinite vacuum level, then the electron affinity rule must be valid in the absence of interface states. GRA

N83-16243# Oak Ridge National Lab., Tenn.
ELECTRICAL AND STRUCTURAL PROPERTIES OF GRAIN BOUNDARY IN POLYCRYSTALLINE Si
R. T. Young, J. Narayan, and Y. K. Chang Nov. 1981 8 p refs Presented at Ann. Meeting of the Mater. Res. Soc., Boston, 16 Nov. 1981 Submitted for publication
(Contract W-7405-eng-26)
(DE82-003984; CONF-811122-25) Avail: NTIS HC A02/MF A01

A special type of high angle grain boundary with mirror symmetry of the crystallographic orientation between the two grains was examined electrically and structurally. Transmission electron microscopy investigations show the nonuniform nature of the grain boundary. Both coherent and incoherent regions are observed along the boundary plane, and the types of dislocations and their densities vary from place to place. Electrical measurements of the boundary properties indicate no measurable barrier height. Heat treatment of the sample in an oxygen atmosphere at 950 C for 30 min did not change the boundary resistance, however, recombination effects are enhanced after boron diffusion. When pulsed laser radiation was used to process this material, it was found that the grain boundary structures were modified by laser-induced surface melting, i.e., incoherent boundaries were converted to coherent boundaries in the melted region. DOE

N83-16244# Brookhaven National Lab., Upton, N. Y. Dept. of Metallurgy.
STABILITY OF SOME SOFT-X-RAY MONOCHROMATOR CRYSTALS IN SYNCHROTRON RADIATION
J. Wong (GE, Schenectady, N.Y.), W. L. Roth (State Univ. of New York at Stony Brook), B. W. Batterman (Cornell Univ.), L. E. Berman (Connecticut Univ.), D. M. Pease, S. Heald (Stanford Univ.), and T. Barbee 1981 11 p refs Presented at the 2nd Natl. Conf. on Synchrotron Radiation Instrumentation, Ithaca, N.Y., 15 Jul. 1981
(Contract DE-AC02-76CH-00016)

(DE82-001819; BNL-30166; CONF-810750-10) Avail: NTIS HC A02/MF A01

The stability in synchrotron radiation of beta alumina and beryl were investigated by exposing the crystals in a white beam of CHESS operating at 5.2 GeV electron energy over 100 hours at an average radiant power of 28 W sq cm. Rocking curves at the CuK/sub alpha energy were used to monitor the diffraction properties before and after exposure to synchrotron radiation. A Si(220) crystal was used as the first crystal. It was found that both materials exhibit no catastrophic material failure. Beta alumina is clearly proven stable with no degradation of its rocking characteristics. There was in fact indication of reflectivity improvement after exposure. Results on beryl are not conclusive because the starting material (a mineral specimen) had a lot of inherent microstructural and crystallographic defects. Rocking curves in the soft X-ray region at 10.5 A were also determined using a (1010) RAP crystal as first crystal. A 19 layer 50 A d-spacing Nb-C sputtered film was also characterized for comparison. DOE

N83-16245# Melbourne Univ., Parkville (Australia). School of Physics.

SEMICONDUCTOR ANALYSIS WITH A CHANNELED HELIUM MICROBEAM

S. A. Ingarfield, C. D. McKenzie, K. T. Short (RMIT, Melbourne, Australia), and J. S. Williams (RMIT, Melbourne, Australia) 1981 19 p refs Presented at 5th Intern. Conf. on Ion Beam Analysis, Sydney, 16 Feb. 1981

(UM-P-81/27; CONF-810231-3) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The use of a channeled helium microbeam for analysis of damage and dopant distributions in semiconductors is described. Practical difficulties and potential problems associated with the channeling of microbeams in semiconductors have been examined. In particular, the following factors have been characterized: (1) the effect of both convergence of focused beam and beam scanning on the quality of channeling; (2) damage produced by the probe ions; and (3) local beam heating effects arising from high current densities. Acceptable channeling has been obtained (minimum yield approaching 4%) under a variety of focusing and scanning conditions which are suitable for analysis of device structures. The capabilities of the technique are demonstrated by monitoring variations in local damage and impurity depth distributions across a narrow (less than 2mm) region of an ion implanted silicon wafer. DOE

N83-16246# Oak Ridge National Lab., Tenn. Solid State Div.

PHOTOLUMINESCENCE OF PULSED RUBY LASER ANNEALED CRYSTALLINE AND ION IMPLANTED GaAs

Douglas H. Lowndes and Bernard J. Feldman (Missouri Univ.) Nov. 1981 7 p refs Presented at the Ann. Meeting of the Mater. Res. Soc., Boston, 16 Nov. 1981

(Contract W-7405-eng-26)

(DE82-004116; CONF-811122-31) Avail: NTIS HC A02/MF A01

In an effort to understand the origin of effects earlier found to be present in p-n junctions formed by pulsed laser annealing (PLA) of ion implanted semiconducting GaAs, photoluminescence (PL) studies were carried out. PL spectra have been obtained at 4K, 77K and 300K, for both n- and p-type GaAs, for laser energy densities 0 equal to or less than E/sub 1/ equal to or less than 0.6 J/sq cm. It is found that PLA of c-GaAs alters the PL spectrum and decreases the PL intensity, corresponding to an increase in density of non-radiative recombination centers with increasing E/sub 1/. The variation of PL intensity with E/sub 1/ is found to be different for n- and p-type material. No PL is observed from high dose (1 or 5 x 10 to the 15th power ions/sq cm) Si- or Zn-implanted GaAs, either before or after laser annealing. The results suggest that the ion implantation step is primarily responsible for formation of defects associated with the loss of radiative recombination, with pulsed annealing contributing only secondarily. DOE

N83-16247# United Kingdom Atomic Energy Authority, Harwell (England). Nuclear Physics Div.

EROSION AND TRANSFER IN ELECTRICAL CONTACTS MEASURED USING THE THIN LAYER ACTIVATION TECHNIQUE

P. M. Read Aug. 1982 17 p refs

(AERE-R-10557) Copyright. Avail: Issuing Activity

Erosion and transfer of material in electrical contacts was measured using an ion beam activation technique. The technique is shown to be a sensitive method enabling accurate quantification of these effects. The possibility of reducing the rate of erosion of tungsten electrodes by ion implantation of silver was also investigated but no significant effect was observed. M.G.

N83-16248# Atomic Energy Research Establishment, Harwell (England). Materials Development Div.

SPIN STATE EQUILIBRIA AND THE SEMICONDUCTOR TO METAL TRANSITION OF LaCoO-3

G. Thornton (Manchester Univ.), B. C. Tofield, and D. E. Williams Aug. 1972 11 p refs

(AERE-R-10637) Copyright. Avail: Issuing Activity

Neutron diffraction, data and electrical conductivity measurements were used to study first-order localized to itinerant electron phase transition of LaCoO3 near 1210 K. A broad higher-order semiconductor to metal transition was observed between approximately 520 K and 750 K. These data simplify possible interpretations of the electronic behavior of LaCoO3. S.L.

N83-16249# Atomic Energy Research Establishment, Harwell (England). Metallurgy Div.

INITIAL EXPERIENCE OF MANUFACTURE AND PROPERTY MEASUREMENTS ON PIEZOELECTRIC CABLE

G. H. Broomfield Nov. 1981 24 p refs

(AERE-R-9066) Copyright. Avail: Issuing Activity

Metal sheathed piezoelectric cable were made with copper conductors and sheaths using lead-zirconate-titanate piezoelectric material. Assemblies were also made with stainless steel outer sheaths. Poling produced piezoelectric behavior such that the cables formed high sensitivity load and stress monitors. Moderate pressure sensitivity was obtained and interdevice transmission through nonconducting fluid observed. Under some conditions anomalous charge rise and fall times were noted. No piezoelectric resonances were detected near the calculated frequencies for the thickness modes or elsewhere. S.L.

N83-16250# Atomic Energy Research Establishment, Harwell (England). Materials Physics Div.

ULTRASONIC VELOCITIES IN ANISOTROPIC POLYCRYSTALLINE AGGREGATES

C. M. Sayers Apr. 1982 23 p refs

(AERE-R-10488) Avail: NTIS HC A02/MF A01

The ultrasonic velocities in a polycrystalline aggregate of cubic crystals with orthorhombic symmetry are derived. Use is made of the formalism of Roe for treating the texture of polycrystalline aggregates. It is shown how information about the crystallite orientation distribution function can be derived from ultrasonic velocity measurements. This enables the construction of ultrasonic pole figures, which may be compared with those obtained with neutron diffraction. Application is made to the effect of texture on ultrasonic propagation in austenitic welds. Author

N83-15877# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DEEP IMPURITY TRAPPING CONCEPTS FOR POWER SEMICONDUCTOR DEVICES Final Report

Gale R. Sundberg *In* R and D Associates Proc. of the AFOSR Spec. Conf. on Prime-Power for High Energy Space Systems, Vol. 2 1982 39 p refs (For primary document see N83-15860 06-44)

Avail: NTIS HC A99/MF A01 CSCL 20L

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

No abstracts in this category.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N83-16251# Oak Ridge Y-12 Plant, Tenn.
PRIDE: PRODUCTIVITY THROUGH RECOGNITION, INVOLVEMENT, AND DEVELOPMENT OF EMPLOYEES
B. J. White 1981 8 p Presented at the AIIE Fall Ind. Eng. Conf., Washington, 6-9 Dec. 1981
(Contract W-7405-eng-26)
(DE82-001826; Y-DN-139; CONF-811210-1) Avail: NTIS HC A02/MF A01

Improvements in productivity and quality of work life are being achieved in a non-profit environment through top management support, a specific functional organization, and a comprehensive plan of action focusing on employee awareness and involvement. Several improvement incentive techniques, including quality circles, were implemented, and a measurement program is being developed to evaluate improvement gains. DOE

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N83-16252# Army Missile Command, Redstone Arsenal, Ala. Systems Simulation and Development Directorate.
A TECHNICAL VIEW OF COST/SCHEDULE CONTROL SYSTEM CRITERIA
M. M. Hallum, III Dec. 1981 15 p refs
(AD-A120005; AD-E950285; DRSMI/RD-82-8-TR) Avail: NTIS HC A02/MF A01 CSCL 05/10

The objective of this study was to bring an engineer's technical view to the Cost/Schedule Control System Critieria (C/S CSC) and to make technical and engineering personnel aware of the potential benefits of C/S CSC. GRA

N83-16253# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Directorate of Management Services.
AFWAL FY81 TECHNICAL ACCOMPLISHMENTS Final Technical Report
Russell S. Hoff, Jr. Apr. 1982 76 p
(AD-A120682; AFWAL-TR-82-0001) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report contains highlights of significant technical achievements made during FY 81. The document exemplifies the broad range of R/D activities being undertaken within AFWAL and the significance of the technological contributions being made to enhance Air Force operational capabilities. The accomplishments have been grouped by Laboratory to assist the reader in understanding the technologies covered. Points of contact have been identified for each accomplishment, if additional information on the subject is desired. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N83-16254*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NSSDC DATA LISTING
Sep. 1982 69 p
(NASA-TM-84880; WDC-A-RS-82-23; NAS 1.15:84880) Avail: NTIS HC A04/MF A01 CSCL 05B

The first part of this listing, Satellite Data, is in an abbreviated form compared to the data catalogs published by NSSDC. It is organized by NSSDC spacecraft common name. The launch date and NSSDC ID are printed for each spacecraft. The experiments are listed alphabetically by the principal investigator's or team leader's last name following the spacecraft name. The experiment name and NSSDC ID are printed for each experiment. The data sets are listed by NSSDC ID following the experiment name. The data set name, data form code, quantity of data, and the time span of the data as verified by NSSDC are printed for each data set. Author

N83-16255# Department of Energy, Oak Ridge, Tenn. Technical Information Center.
ENERGY DATA BASE: OUTPUT MAGNETIC TAPE DESCRIPTIONS
A. E. Busse, ed. Jun. 1982 20 p refs
(DE82-014313; DOE/TIC-4581/R5) Avail: NTIS HC A02/MF A01

A format for disseminating bibliographic citations, abstracts and subject content indicators for energy information on computer readable magnetic tape is described. The magnetic tapes contain information incorporated into the DOE data base. This base is used by TIC to generate multiple publications and to support information retrieval activities. Information, or data, pertinent to one bibliographic reference will be called on entry. The entries are logically composed of data elements (such as title, authors, etc.). This format supersedes a previous version, used since 1974, as described in Report TID-4581-R4. The format has been revised to permit incorporation of DOE/TIC bibliographic data encompassing the broader scope of information related to the development or use of energy resources. DOE

N83-16256# King Research, Inc., Rockville, Md.
VALUE OF THE ENERGY DATA BASE
DOE 31 Mar. 1982 85 p refs Sponsored by DOE
(DE82-014250) Avail: NTIS HC A05/MF A01

The Energy Information System is described. The value of the database is estimated. N.W.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N83-16257*# Gould, Inc., Rolling Meadows, Ill.
IMPROVED SCR ac MOTOR CONTROLLER FOR BATTERY POWERED URBAN ELECTRIC VEHICLES Final Report
Thomas S. Latos Dec. 1982 319 p refs
(Contracts DEN3-60; DE-AI01-77CS-51044)
(NASA-CR-167919; DOE/NASA/0060-82/1; NAS 1.26:167919; Rept-815-008) Avail: NTIS HC A14/MF A01 CSCL 13F

An improved ac motor controller, which when coupled to a standard ac induction motor and a dc propulsion battery would provide a complete electric vehicle power train with the exception of the mechanical transmission and drive wheels was designed. In such a system, the motor controller converts the dc electrical power available at the battery terminals to ac electrical power for the induction motor in response to the drivers commands. The performance requirements of a hypothetical electric vehicle with an upper weight bound of 1590 kg (3500 lb) were used to determine the power rating of the controller. Vehicle acceleration capability, top speed, and gradeability requisites were contained in the Society of Automotive Engineers (SAE) Schedule 227a(d) driving cycle. The important capabilities contained in this driving cycle are a vehicle acceleration requirement of 0 to 72.4 kmph (0 to 45 mph) in 28 seconds a top speed of 88.5 kmph (55 mph), and the ability to negotiate a 10% grade at 48 kmph (30 mph). A 10% grade is defined as one foot of vertical rise per 10 feet of horizontal distance. S.L.

N83-16258# Naval Ship Research and Development Center, Bethesda, Md.
TECHNOLOGY TRANSFER IN THE NAVY. THE HISTORICAL BACKGROUND Final Report, Mar. - Jun. 1982
David Kite Allison Sep. 1982 23 p refs
(AD-A119477; DTNSRDC-82/091) Avail: NTIS HC A02/MF A01 CSCL 05/4

The several meanings that the phrase technology transfer carries in policy discussions are explained and traditional DOD scientific and technical information programs that relate to technology transfer are reviewed as well as technology transfer from DOD to private industry, especially to defense contractors. The principal provisions of the 1980 Stevenson-Wydler Act and reason for its passage are discussed. NASA's technology transfer program and the Federal Laboratory Consortium, both existing programs used by Congress in developing ideas for the new law, are explored. Important issues to be considered by Navy laboratory management as the law is put into effect are delineated. It is concluded that Congress, in passing the Stevenson-Wydler Act, did not fully consider what relationship the new technology transfer programs it was requiring in the Executive Branch should bear to existing programs with similar purposes. GRA

N83-16259# Los Alamos Scientific Lab., N. Mex.
APPLICATION OF FUEL CELLS TO HIGHWAY AND NONHIGHWAY TRANSPORTATION
J. R. Huff, J. B. McCormich, D. K. Lynn, R. E. Bobbett, G. R. Dooley, C. R. Derouin, H. S. Murray, and S. Srinivasan 1981 11 p refs Presented at the IGT Fuel Cells Technol. Status and Applications Conf., Chicago, 16-18 Nov. 1981
(Contract W-7405-eng-36)
(DE82-004365; LA-UR-81-3424; CONF-811148-1) Avail: NTIS HC A02/MF A01

Fuel cells are a promising alternate power source for transportation applications. Modeling studies have indicated the potential for providing highway vehicles with performance and range comparable to those provided by internal combustion engines. Fuel cells are efficient and therefore reduce energy consumption. They are nonpolluting in terms of both air and noise pollution - highly desirable features for urban applications. In addition, they can operate on nonpetroleum fuels such as hydrogen or hydrogen in combined form, for example, methanol or ammonia, thereby reducing the nation's petroleum dependency. The feasibility of using fuel cells in nonhighway transportation, i.e., rail and marine was also investigated. DOE

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N83-16260*# Hawaii Univ., Honolulu. Inst. for Astronomy.
ROTATIONAL MODULATION OF THE CHROMOSPHERIC ACTIVITY IN THE YOUNG SOLAR-TYPE STAR, X-1 ORIONIS
Ann Merchant Boesgaard and Theodore Simon [1982] 4 p refs
(Grants NGL-12-001-011; NAG5-146)
(NASA-CR-169711; NAS 1.26:169711) Avail: NTIS HC A02/MF A01 CSCL 03A

The IUE satellite was used to observe one of the youngest G stars (GO V) for which Duncan (1981) derives an age of 6 x 10 to the 8th power years from the Li abundance. Rotational modulation was looked for in the emission flux in the chromospheric and transition region lines of this star. Variations in the Ca 11 K-lines profile were studied with the CHF telescope at Mauna Kea. Results show that the same modulation of the emission flux of Ca 11 due to stellar rotation is present in the transition region feature of C IV and probably of He II. For other UV lines the modulation is not apparent, due to a more complex surface distribution of the active areas or supergranulation network, or a shorter lifetime of the conditions which give rise to these features, or to the uncertainities in the measured line strengths. The Mg II emission flux is constant to within + or - 3.4% implying a rather uniform distribution of Mg II emission areas. The Ca II emission not only shows a measurable variation in intensity but also variations in detailed line profile shape when observed at high resolution. A.R.H.

N83-16261*# Hawaii Univ., Honolulu. Inst. for Astronomy.
IUE OBSERVATIONS OF THE CHROMOSPHERIC ACTIVITY-AGE RELATION IN YOUNG SOLAR-TYPE STARS
Theodore Simon and Ann Merchant Boesgaard [1982] 4 p refs
(Grant NGL-12-001-011)
(NASA-CR-169710; NAS 1.26:169710) Avail: NTIS HC A02/MF A01 CSCL 03A

Ultraviolet data obtained with the IUE spacecraft are presented for a dozen solar-type stars in the field. The stars are of spectral

type F6 V - G1 V; on the basis of their high Li content, they range in age from 0.1 to 2.8 Gyr. The evolution of transition regions and chromospheric emission with stellar age is studied along with the surface distribution of magnetically active regions as revealed by rotational modulation of UV emission line fluxes. M.G.

N83-16262# Maryland Univ., College Park.
ARCHAEOASTRONOMY: THE BULLETIN OF THE CENTER FOR ARCHAEOASTRONOMY
Apr. 1982 49 p refs
Avail: NTIS HC A03/MF A01

The origin of Libyan Desert glass is discussed in relation to its geological occurrence. The utilization of the glass in prehistory is also considered. The Basque calender is speculated, along with the idea of a combination of lunar phases and lunar mansions. S.L.

N83-16263*# Texas Univ., Austin. Dept. of Astronomy.
INFRARED OBSERVATIONS OF OB STAR FORMATION IN NGC 6334
Paul M. Harvey and Ian Gatley (United Kingdom Infrared Telescope, Hilo, Hawaii) Nov. 1982 39 p refs
(Grants NAG2-67; NGR-03-002-390)
(NASA-TM-84308; A-9156; NAS 1.15:84308) Avail: NTIS HC A03/MF A01 CSCL 03A

Infrared photometry and maps from 2 to 100 microns are presented for three of the principal far infrared sources in NGC 6334. Each region is powered by two or more very young stars. The distribution of dust and ionized gas is probably strongly affected by the presence of the embedded stars; one of the sources is a blister H II region, another has a bipolar structure, and the third exhibits asymmetric temperature structure. The presence of protostellar objects throughout the region suggests that star formation has occurred nearly simultaneously in the whole molecular cloud rather than having been triggered sequentially from within. S.L.

N83-16264*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION FOR THE MACHINE-READABLE VERSION OF THE CATALOGUE OF NEARBY STARS, EDITION 1969
Wayne H. Warren, Jr. Oct. 1982 16 p ref
(NASA-TM-85128; NSSDC/WDC-A-R/S-82-26; NAS 1.15:85128) Avail: NTIS HC A02/MF A01 CSCL 03A

The Catalogue of Nearby Stars, Edition 1969 (Gliese 1969) contains a number of modifications and additions to the 1957 catalog. It should be mentioned that the 1969 edition lists: (1) all 915 stars of the first edition, even though newer parallaxes place some of the stars below the catalog limit; (2) almost all known stars having trigonometric parallaxes > or = 0.045 deg, although in some cases the mean values of trigonometric and spectral or photometric parallaxes are > or = 0.045 deg. Pleiades stars and the carbon star X Cnc have been omitted; and (3) all stars with mean (resulting) parallaxes > or = 0.045 deg. The resulting catalog contains 1529 single stars and systems with a total of 1890 components (not including spectroscopic and astrometric companions). The machine-readable version of the catalog is described. It is intended to enable users to read and process the data without problems or guesswork. J.M.S.

N83-16265*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION FOR THE MACHINE-READABLE VERSION OF A FINDING LIST OF STARS OF SPECTRAL TYPE F2 AND EARLIER IN A NORTH GALACTIC POLE REGION
Wayne H. Warren, Jr. Oct. 1982 15 p ref
(NASA-TM-85129; NSSDC/WDC-A-R/S-82-27; NAS 1.15:85129) Avail: NTIS HC A02/MF A01 CSCL 03A

The machine-readable data set is the result of an objective-prism survey made with an 80 cm/120 cm Schmidt telescope. The F2 and earlier stars were isolated from later type objects by using the MK classification criteria. The catalog contains 601 stars and includes cross identifications to the BD and HD catalogs, coordinates, photographic magnitudes and spectral types. A separate file contains the remarks from the original data tables merged with those following the data. The machine-readable files are described. S.L.

N83-16266# California Univ., Livermore. Lawrence Livermore Lab.
CONSTRAINTS ON THE ATMOSPHERES OF TYPE I SUPERNOVAE
Timothy S. Axelrod 19 Oct. 1981 12 p refs Presented at the NATO Advanced Study Inst. on Supernovae, Cambridge, England, 29 Jun. - 11 Jul. 1981
(Contract W-7405-eng-48)
(DE82-002674; UCRL-86850; CONF-8106163-3) Avail: NTIS HC A02/MF A01

The Ca II absorption lines observed in the late time optical spectra of Type I supernovae are analyzed in the context of the Ni-56 model. The analysis indicates that a metal rich atmosphere of mass approximately 0.2 M/sub solar mass/surrounds the Ni-56 core. This result is consistent with properties of the atmosphere derived from spectra near maximum light. DOE

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N83-16267*# Wheaton Coll., Norton, Mass. Dept. of Physics and Astronomy.
THE IONIZATION STRUCTURE OF PLANETARY NEBULAE. 3: NGC 7009
Timothy Barker [1982] 25 p refs
(Grant NsG-5376)
(NASA-CR-169712; NAS 1.26:169712) Avail: NTIS HC A02/MF A01 CSCL 03B

Spectrophotometric observations of emission line intensities were made in 8 positions in the planetary nebula NGC 7009. For the 6 brightest positions, the coverage is from 1400 A to 10,000 A. Standard equations used to correct for the existence of elements in other than the optical observable ionization stages give results over a wide range of ionization that are consistent and agree with abundances calculated using ultraviolet lines. This result is particularly gratifying for N because previously the standard formula gave inconsistent abundances in NGC 7009. The major outstanding problem is that the lambda 4267 CII line implies a C(2+) abundance as much as 12 times greater than that determined from the UV lines. This discrepancy is greatest nearest the central star, as is the case in the planetary nebula NGC 6720. The logarithmic abundances (relative to H=12.00) are: He=11.07, O=8.68, N=8.10, Ne=8.16, C=8.18, Ar=6.36, and S=7.12. The average of the Ne, Ar, and S abundances agrees to within 5% of that for NGC 6720, but the O, N, nd C abundances average 1.9 times lower in NGC 7009, suggesting that here may have been mixing of processed material in the planetary precursor in NGC 6720. S.L.

N83-16268# California Univ., Livermore. Lawrence Livermore Lab.
THEORETICAL MODELS FOR SUPERNOVAE
Stanford E. Woosley (California Univ., Santa Cruz) and Thomas A. Weaver 21 Sep. 1981 71 p refs Presented at the NATO/Adv. Study Inst. on Supernovae, Cambridge, United Kingdom, 28 Jun. - 10 Jul. 1981
(Contract W-7405-eng-48; Grant NSF AST-81-08509)
(DE82-001060; UCRL-86744; CONF-8106163-1) Avail: NTIS HC A04/MF A01

The results of numerical simulations of supernova explosions are presented. Particular emphasis is given to: (1) the nucleosynthesis expected from intermediate mass (10sub solar < or = M < or = 100 Msub solar) Type II supernovae and detonating white dwarf models for Type I supernovae; (2) a realistic estimate

of the gamma-line fluxes expected from this nucleosynthesis; (3) the continued evolution, in one and two dimensions, of intermediate mass stars wherein iron core collapse does not lead to a strong, mass-ejecting shock wave; and (4) the evolution and explosion of vary massive stars (M > 100 Msub solar of both Population I and III. DOE

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N83-16269*# Planetary Science Inst., Pasadena, Calif.
PLANETARY GEOLOGY: IMPACT PROCESSES ON ASTEROIDS Final Report
Clark R. Chapman, Donald R. Davis, Richard Greenberg, and Stuart J. Weidenschilling 1982 44 p refs
(Contract NASw-3208)
(NASA-CR-169709; NAS 1.26:169709) Avail: NTIS HC A03/MF A01 CSCL 03B

The fundamental geological and geophysical properties of asteroids were studied by theoretical and simulation studies of their collisional evolution. Numerical simulations incorporating realistic physical models were developed to study the collisional evolution of hypothetical asteroid populations over the age of the solar system. Ideas and models are constrained by the observed distributions of sizes, shapes, and spin rates in the asteroid belt, by properties of Hirayama families, and by experimental studies of cratering and collisional phenomena. It is suggested that many asteroids are gravitationally-bound 'rubble piles.' Those that rotate rapidly may have nonspherical quasi-equilibrium shapes, such as ellipsoids or binaries. Through comparison of models with astronomical data, physical properties of these asteroids (including bulk density) are determined, and physical processes that have operated in the solar system in primordial and subsequent epochs are studied. S.L.

N83-16270*# National Aeronautics and Space Administration, Washington, D. C.
REPORTS OF PLANETARY GEOLOGY PROGRAM, 1982
Henry E. Holt, comp. Dec. 1982 416 p refs
(NASA-TM-85127; EL-4; NAS 1.15:85127) Avail: NTIS HC A18/MF A01 CSCL 03B

Work conducted in the Planetary Geology program is summarized. The following categories are presented: outer solar system satellites; asteroids and comets; Venus; cratering processes and landform development; volcanic processes and landforms; aolian processes and landforms; fluvial processes and landform development; periglacial and permafrost processes; structure, tectonics and stratigraphy; remote sensing and regolith studies; geologic mapping, cartography and geodesy. E.A.K.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N83-16271*# National Aeronautics and Space Administration, Washington, D. C.
SUN, EARTH AND MAN: THE NEED TO KNOW. THE QUEST FOR KNOWLEDGE OF SUN-EARTH RELATIONS
Edward Peary Stafford 1982 82 p Original contains color illustrations
(NASA-EP-172; NAS 1.19:172) Avail: NTIS HC A05/MF A01; SOD HC $5.50 as 033-000-00848-1 CSCL 03B

Solar physics and the effects of emanations from the Sun on communications and Earth's weather and climate are discussed. Scientific interest in the solar system from the old Stone Age to the present is reviewed with particular emphasis on the objectives sought and information obtained by Explorer satellites, Pioneer satellites, Skylab, Helios, ISEE, the solar maximum mission, and the Dynamics Explorer. The goals of missions planned for the 1980's are discussed including those using space shuttle, Spacelab, the Solar Mesosphere Explorer, the solar optical telescope, the upper atmosphere research satellite, and the solar probe. The objectives of the international solar polar mission and of the Origin of Plasma in Earth's Neighborhood mission are also delineated. Other missions being considered are reviewed and the prospect of taming the fusion process to provide clean, harmless electrical energy like that obtained from the Sun is entertained. A.R.H.

N83-16272*# California Inst. of Tech., Pasadena.
THE ISOTROPIC CONDITION OF ENERGETIC PARTICLES EMITTED FROM A LARGE SOLAR FLARE Ph.D. Thesis
John Spalding 1983 202 p refs
(Contract NAS5-20721; Grant NGR-05-002-160)
(NASA-CR-169744; NAS 1.26:169744; SRL-82-11) Avail: NTIS HC A10/MF A01 CSCL 03B

Isotope abundance ratios for 5 to 50 MeV/nuc nuclei from a large solar flare were measured. The measurements were made by the heavy isotope spectrometer telescope (HIST) on the ISEE-3 satellite orbiting the Sun near an Earth-Sun liberation point approximately one million miles sunward of the Earth. Finite values for the isotope abundance ratios C-13/C-12, N-15/N-14, O-18/O-16, Ne-22/Ne-20, Mg-25/Mg-24, and Mg-26/Mg-24, and upper limits for the isotope abundance ratios He-3/He-4, C-14/C-12, O-17/O-16 and Ne-21/Ne-20 were reported. Element abundances and spectra were measured to compare the flare with other reported flares. The flare is a typical large flare with low Fe/O abundance < or = to 0.1). For C-13/C-12, N-15/N-14, O-18/O-16, Mg-25/Mg-24 and Mg-26/Mg-24 isotope abundance ratios agree with the solar system abundance ratios. Measurement for Ne-22/Ne-20 agree with the isotopic composition of the meteoritic component neon-A. S.L.

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

No abstracts in this category.

99 GENERAL

N83-16273*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RESEARCH AND TECHNOLOGY ANNUAL REPORT, 1982
Nov. 1982 77 p
(NASA-TM-84312; A-9136; NAS 1.15:84312) Avail: NTIS HC A05/MF A01 CSCL 05A

Various research and technology activities are described. Highlights of these accomplishments indicate varied and highly productive reseach efforts. S.L.

N83-16274# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 36, NUMBER 7
Donald R. Barr and Don J. Peters 31 Jul. 1982 36 p
(AD-A120500; ESN-36-7) Avail: NTIS HC A03/MF A01 CSCL 05/2

This is a monthly publication presenting brief articles concerning recent developments in European Scientific Research. It is hoped that these articles (which do not constitute part of the Scientific Literature) may prove of value to American scientists by calling attention to current developments and to institutions and individuals engaged in these scientific efforts. The articles are written primarily by members of the staff of ONRL and occasionally articles are prepared by, or in cooperation with members of the scientific staffs of the United States Air Force European Office of Aerospace Research and Development and the United States Army Research and Standardization Group. Articles are also contributed by visiting Stateside scientists. GRA

SUBJECT INDEX

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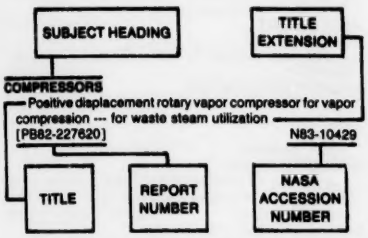

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7051).

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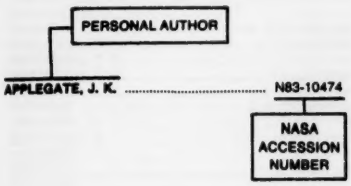

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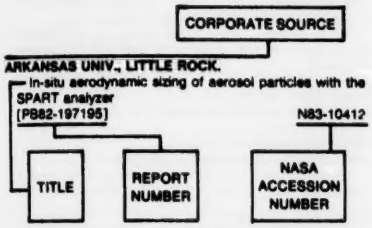

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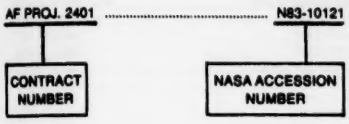

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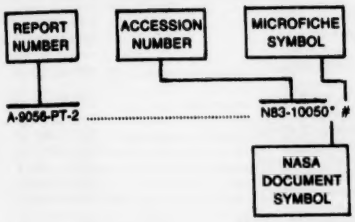

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